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PROGRAMS FOR COMPUTING THE STUDENT DISTRIBUTION AND RELATED BAYESIAN FUNCTIONS

by

Jerome Bracken
Arthur Schleifer, Jr.

Serial T-151

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THE GEORGE WASHINGTON UNIVERSITY
Logistics Research Project

Abstract
of
Serial T-181

PROGRAMS FOR COMPUTING THE STUDENT DISTRIBUTION AND RELATED BAYESIAN FUNCTIONS

by

Jerome Bracken*
Arthur Schleifer, Jr.**

This report contains programs used in computing the tables presented in Jerome Bracken and Arthur Schleifer, Jr., Tables for Normal Sampling with Unknown Variance: The Student Distribution and Economically Optimal Sampling Plans, Division of Research, Graduate School of Business Administration, Harvard University, 1964. The tables are essentially of two kinds: tables of the ordinary Student "t" density and cumulative functions, and tables to facilitate Bayesian analysis of certain commonly occurring decision problems in which sampling may or may not be involved. The programs given in this report could be used to compute tables for parameter values other than those of the book either by reading in alternative data, or by straightforward modification where the parameters of the book are included in the programs. The programs are written in FORTRAN II, and in computing the tables in the book they were used on the IBM 7090 and IBM 1401. It should be noted that new programs have been written to perform some of the computations faster, more accurately, or more efficiently.

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THE GEORGE WASHINGTON UNIVERSITY
Logistics Research Project

PROGRAMS FOR COMPUTING THE STUDENT DISTRIBUTION AND RELATED BAYESIAN FUNCTIONS

by

Jerome Bracken
Arthur Schleifer, Jr.

1. Introduction

This report contains the computer programs used in computing the tables presented in Bracken and Schleifer [1]. The tables are essentially of two kinds: tables of Student "t" density and cumulative functions, and tables to facilitate Bayesian analysis of certain commonly occurring decision problems in which sampling may or may not be involved. Theoretical aspects of the Bayesian analysis and proofs of the formulas used in calculating the Bayesian tables are given in Schleifer [3], and extend results given in Raiffa and Schlaifer [2].

Bracken and Schleifer [1] includes an introduction which describes the tables, discusses prior, posterior and preposterior properties of Student distributions, presents the two-action problems with linear utility which can be analyzed by means of the optimal sample size and maximal net gain tables, and discusses other applications of the tables. Interpolation in the tables and details of their computation and verification are considered.

Although other tables of the Student "t" density and cumulative functions have been published, the most notable being Smirnov [4], the computer programs used in their computation have not been published or described.

2. Computational Methods and Computers Used

Section 6 of Bracken and Schleifer [1] discusses computation and verification of the tables in some detail, and should be used in conjunction with the programs given in this report. The programs are organized in a manner which closely parallels the discussion of their computation and verification.

All of the computer programs are in FORTRAN II, and were written for one or the other of two IBM computers -- the 7090 and the 1401. The tables of the Student density, right-tail, and linear-loss functions f_{S*}, G_{S*} and L_{S*} were computed on the 7090 in double precision. They were further edited for printing on the 7090 in single precision. Included as starting information in the double precision computations were values of $B(\frac{1}{2},\frac{1}{2}\nu)$ and $G_{S*}(t=10|\nu)$ to 16 significant figures, which had previously been computed on the 1401. It should be noted that a program for computing $B(\frac{1}{2},\frac{1}{2}\nu)$ has been written in SPS for the IBM 1620, but is not included here. The optimal sample size and net gain functions were computed on the 7090 in double precision. Supplementary programs for computing optimal sample size and net gain, written in FORTRAN II for the 1401 and used to check the computations on the 7090, are also included in this report.

3. Computer Program Summary

This section presents a summary of the computer programs. Inputs and outputs of each program are given. Programs of sections A, B, D, and E were run on the 7090, programs of sections C and F on the 1401.

A. Programs for Computing Tables f_{S*}, G_{S*} and L_{S*}

A.1 Standardized Student Functions for $\nu < \infty$
Inputs - none (contains $G_{S*}(t=10|\nu)$ and $B(\frac{1}{2},\frac{1}{2}\nu)$ for all ν's)
Outputs - f_{S*}, G_{S*} and L_{S*}, $t = 0(.01)10$

A.2 Standardized Student Functions for $\nu = \infty$ (Normal)
Inputs - none (contains $G_{S*}(t=10|\nu=\infty)$)
Outputs - f_{S*}, G_{S*} and L_{S*}, $t = 0(.01)10$

B. Program for Printing Tables f_{S*} , G_{S*} and L_{S*}

Inputs - f_{S*} , G_{S*} and L_{S*} , $t = 0(.01)10$, double line indicator
Outputs - f_{S*} , G_{S*} and L_{S*} tables in final form

C. Supplementary Programs for Computing Standardized Student Functions

C.1 Evaluation of $B(\frac{1}{2},\frac{1}{2}\nu)$
Inputs - ν and values of Riemann's zeta function for integral arguments
Outputs - $B(\frac{1}{2},\frac{1}{2}\nu)$

C.2 Finite Series Expansion for $G_{S*}(t|\nu)$, Integral Even $\nu < \infty$
Inputs - ν , $B(\frac{1}{2},\frac{1}{2}\nu)$, t
Outputs - $f_{S*}(t|\nu)$, $G_{S*}(t|\nu)$, $L_{S*}(t|\nu)$

C.3 Finite Series Expansion for $G_{S*}(t|\nu)$, Integral Odd $\nu < \infty$
Inputs - ν , $B(\frac{1}{2},\frac{1}{2}\nu)$, t
Outputs - $f_{S*}(t|\nu)$, $G_{S*}(t|\nu)$, $L_{S*}(t|\nu)$

C.4 Infinite Series Expansion for $G_{S*}(t|\nu)$, Real $\nu < \infty$, $t^2 < \nu$
Inputs - ν , $B(\frac{1}{2},\frac{1}{2}\nu)$, t
Outputs - $f_{S*}(t|\nu)$, $G_{S*}(t|\nu)$, $L_{S*}(t|\nu)$

C.5 Infinite Series Expansion for $G_{S*}(t|\nu)$, Real $\nu < \infty$, $t^2 > \nu$
Inputs - ν , $B(\frac{1}{2},\frac{1}{2}\nu)$, t
Outputs - $f_{S*}(t|\nu)$, $G_{S*}(t|\nu)$, $L_{S*}(t|\nu)$

C.6 Continued Fraction for $G_{S*}(t|\nu=\infty)$, $t > 2$
Inputs - t , n (number of terms in series)
Outputs - $G_{S*}(t|\nu=\infty)$

C.7 Series Expansion for $G_{S*}(t|\nu=\infty)$, $t \leq 2$
Inputs - t , n (maximum number of terms in series)
Outputs - $G_{S*}(t|\nu=\infty)$

D. Programs for Computing and Printing Optimal Sample Size (R) and Maximal Net Gain (Γ)

D.1 R and Γ for $\nu = 1\frac{1}{2},2$
Inputs - index on ν , index on D , cutoff values of θ , index on Λ
Outputs - R , Γ , $\emptyset$, Ψ

D.2 R and Γ for $3 \leq \nu < \infty$

Inputs - index on ν , index on D , cutoff values of θ , index on Λ

Outputs - R , Γ , ϕ , ψ

D.3 R and Γ for $\nu = \infty$

Inputs - index on D , cutoff values of θ , index on Λ

Outputs - R , Γ , ϕ , ψ

D.4 Subprogram for Printing R and Γ

Inputs - R , Γ , ϕ , ψ

Outputs - R , Γ , ϕ , ψ tables in final form

E. Programs for Computing Λ and R Cutoffs

E.1 Λ_c and R_c for $\nu < \infty$

Inputs - index on ν , index on D

Outputs - θ_c , Λ_c , R_c

E.2 Λ_c and R_c for $\nu = \infty$

Inputs - index on D

Outputs - θ_c , Λ_c , R_c

F. Subprogram for Aitken's Interpolation (modification of SHARE Distribution Number 355,408)

Inputs - table of arguments and corresponding function, new argument

Outputs - new function

G. Supplementary Programs for Computing Optimal Sampling Functions

G.1 Optimal Sample Size - First Search Procedure

Inputs - ν , $B(\frac{1}{2},\frac{1}{2}\nu)$, D , Λ , n (maximum number of trials)

Outputs - R

G.2 Optimal Sample Size - Second Search Procedure

Inputs - ν , $B(\frac{1}{2},\frac{1}{2}\nu)$, D , Λ , n (maximum number of trials)

Outputs - R

G.3 Optimal Sample Size - Newton-Raphson Procedure

Inputs - ν , $B(\frac{1}{2},\frac{1}{2}\nu)$, D , Λ , trial R

Outputs - R

G.4 Net Gain for Given Optimal Sample Size, Real $\nu < \infty$, $t^2 < \nu$
Inputs - ν , $B(\frac{1}{2},\frac{1}{2}\nu)$, D , Λ , R
Outputs - Γ

G.5 Net Gain for Given Optimal Sample Size, Real $\nu < \infty$, $t^2 > \nu$
Inputs - ν , $B(\frac{1}{2},\frac{1}{2}\nu)$, D , Λ , R
Outputs - Γ

4. Computer Programs

Computer programs summarized in Section 3 are contained in this section. Each program is identified by title, and the pages are numbered within programs. Comment cards are liberally used, particularly in the larger 7090 programs for computing the Student distributions and the main Bayesian tables.

A.1 Standardized Student Functions for $\nu < \infty$

```
C --- FS, GS, AND FLS, NU LESS THAN INF, T=0(.01)10
C
      PRINT 5
 5    FORMAT(31HOMOUNT OUTPUT TAPE ON LOGICAL 8)
      PAUSE
C
D     DIMENSION FLNUT(19),STVT(19),BETAT(19)
D     DIMENSION T(1001),FS(1001),GS(1001),FLS(1001)
D     DIMENSION TS(91),FSS(91)
C
D     FLNUT(1)=1.
D     FLNUT(2)=1.5
D     FLNUT(3)=2.
D     FLNUT(4)=3.
D     FLNUT(5)=4.
D     FLNUT(6)=5.
D     FLNUT(7)=6.
D     FLNUT(8)=7.
D     FLNUT(9)=8.
D     FLNUT(10)=9.
D     FLNUT(11)=10.
D     FLNUT(12)=12.
D     FLNUT(13)=15.
D     FLNUT(14)=20.
D     FLNUT(15)=24.
D     FLNUT(16)=30.
D     FLNUT(17)=40.
D     FLNUT(18)=60.
D     FLNUT(19)=120.
C
D     STVT(1)=0.31725 51743 05535 69877 E-01
D     STVT(2)=0.11829 67755 68107 78653 E-01
D     STVT(3)= 0.49262285116628 45E-02
D     STVT(4)= 0.10641995292070 75E-02
D     STVT(5)= 0.28100181135799 56E-03
D     STVT(6)= 0.85473787871481 80E-04
D     STVT(7)= 0.28959913774768 13E-04
D     STVT(8)= 0.10697101445386 41E-04
D     STVT(9)= 0.42440907638142 46E-05
D     STVT(10)=0.17891187159623 68E-05
D     STVT'11)=0.79477658779820 60E-06
D     STVT(12)=0.17906618438361 87E-06
D     STVT(13)=0.24984490714624 72E-07
D     STVT(14)=0.15818908793571 94E-08
D     STVT(15)=0.24577627638376 53E-09
D     STVT(16)=0.22876257041148 07E-10
D     STVT(17)=0.96565585020577 88E-12
D     STVT(18)=0.10688429573370 41E-13
D     STVT(19)=0.85697205876805 08E-17
C
D     BETAT(1)= 0.31415926535897 93E+01
D     BETAT(2)= 0.23962804694711 84E+01
D     BETAT(3)= 0.20000000000000 00E+01
D     BETAT(4)= 0.15707963267948 97E+01
D     BETAT(5)= 0.13333333333333 33E+01
D     BETAT(6)= 0.11780972450961 72E+01
D     BETAT(7)= 0.10666666666666 67E+01
```

```
D      BETAT(8)= 0.98174770424681O4E+00
D      BETAT(9)= 0.9142857142857143E+00
D      BETAT(10)=0.8590292412159591E+00
D      BETAT(11)=0.8126984126984127E+00
D      BETAT(12)=0.7388167388167388E+00
D      BETAT(13)=0.6580777580029401E+00
D      BETAT(14)=0.5675463855030419E+00
D      BETAT(15)=0.5170194816176779E+00
D      BETAT(16)=0.4614745534009741E+00
D      BETAT(17)=0.3988173068948810E+00
D      BETAT(18)=0.3249554203948302E+00
D      BETAT(19)=0.2293000137934539E+00
C
       IT= 0
D      T(1)=IT
       DO 10 I= 2,1001
       IT=IT + 1
D      TT=IT
D   10 T(I) = TT/100.
C
       WRITE OUTPUT TAPE 6,80,(T(I),I=1,1001)
C
       IT= 9910
D      TT=IT
D      TS(1)= TT/1000.
       DO 15  I= 2,91
       IT = IT + 1
D      TT= IT
D   15 TS(I) = TT/1000.
C
       WRITE OUTPUT TAPE 6,80,(TS(I),I=1,91)
C
C --- READ NUMBER OF NUS
C
       READ INPUT TAPE 5,20,NUMB
   20  FORMAT(I10)
C
C --- MAIN INDEX
C
       DO  500  IMAIN =1,NUMB
C
C --- READ NU INDEX TO SPECIFY NU
C
       READ INPUT TAPE 5,25,INU
 25    FORMAT(I10)
C
D      FLNU=FLNUT(INU)
D      STV=STVT(INU)
D      BETA=BETAT(INU)
C
D      GS(1001) = STV
C
C --- COMPUTE FS
C
D      TERM1= 1./(BETA*SQRTF(FLNU))
D      EXP=-((FLNU+1.)/2.)
C
```

```
      DO  30 I=1,1001
D30   FS (I)=TERM1* ((1.+(T (I)**2)/FLNU)**EXP)
C
C --- COMPUTE GS
C
      DO 35  I=1,91
D35   FSS(I)=TERM1* ((1.+(TS(I)**2)/FLNU)**EXP)
C
      DO 50  I=2,10
      J= 11-I
      K= 10*(J-1)
D     T1=16067.  *(FSS(K+1)+FSS(K+11))
D     T2=106300. *(FSS(K+2)+FSS(K+10))
D     T3=48525.  *(FSS(K+3)+FSS(K+9))
D     T4=272400. *(FSS(K+4)+FSS(K+8))
D     T5=260550. *(FSS(K+5)+FSS(K+7))
D     T6=427368. *(FSS(K+6))
D     AT1=(5.*0.001)/299376.
D     AT2=T1+T2-T3+T4-T5+T6
D     A=AT1*AT2
      L=1002-I
      M=1002-I+1
D50   GS(L)=GS(M)+A
C
      DO 60 I=11,1001
      J= 1001-I
D     T1=16067.  *(FS (J+1)+FS (J+11))
D     T2=106300. *(FS (J+2)+FS (J+10))
D     T3=48525.  *(FS (J+3)+FS (J+9))
D     T4=272400. *(FS (J+4)+FS (J+8))
D     T5=260550. *(FS (J+5)+FS (J+7))
D     T6=427368. *(FS (J+6))
D     AT1=(5.*0.01 )/299376.
D     AT2=T1+T2-T3+T4-T5+T6
D     A=AT1*AT2
      K=1002-I
      L=1002-I+10
D60   GS(K)=GS(L)+A
C
C --- COMPUTE FLS
C
D     BOT = FLNU-1.
      DO 70  I=1,1001
D  70 FLS(I)=((FLNU+ T(I)**2.)/BOT)*FS(I) - T(I)* GS(I)
C
C --- WRITE FS,GS,FLS
C
      WRITE OUTPUT TAPE  8, 80,(FS(I),I=1,1001)
      WRITE OUTPUT TAPE  8, 80,(GS(I),I=1,1001)
      WRITE OUTPUT TAPE  8, 80,(FLS(I),I=1,1001)
   80 FORMAT (5E20.8)
C
C --- INDEX
C
  500 CONTINUE
C
C --- END
```

```
C
      END FILE 8
      PRINT 999
  999 FORMAT(20H1 DISMOUNT LOGICAL 8)
      PAUSE
      CALL EXIT
      END
```

A.2 Standardized Student Functions for. $\nu = \infty$

```
C --- FS, GS, AND FLS, NU EQUALS INF(NORMAL), T=0(.01)10
C
      PRINT 5
 5    FORMAT(31HOMOUNT OUTPUT TAPE ON LOGICAL 8)
      PAUSE
C
D     DIMENSION FLNUT(19),STVT(19),BETAT(19)
D     DIMENSION T(1001),FS(1001),GS(1001),FLS(1001)
D     DIMENSION TS(91),FSS(91)
C
      IT= 0
D     T(1)=IT
      DO 10 I= 2,1001
      IT=IT + 1
D     TT=IT
D  10 T(I) = TT/100.
C
      WRITE OUTPUT TAPE 6,80,(T(I),I=1,1001)
C
      IT= 9910
D     TT=IT
D     TS(1)= TT/1000.
      DO 15  I= 2,91
      IT = IT + 1
D     TT= IT
D  15 TS(I) = TT/1000.
C
      WRITE OUTPUT TAPE 6,80,(TS(I),I=1,91)
C
C --- COMPUTE FS
C
D     CON=1./SQRTF(2.*3.141592653589793)
C
      DO  30 I=1,1001
D30   FS(I)=CON * EXPF( (-.5) * T(I)**2)
C
C --- COMPUTE GS
C
      GS(1001)=.76198 53024 16059 16 E-23
C
      DO 35  I=1,91
D35   FSS(I)=CON * EXPF( (-.5) * TS(I)**2)
C
      DO 50  I=2,10
      J= 11-I
      K= 10*(J-1)
D     T1=16067.  *(FSS(K+1)+FSS(K+11))
D     T2=106300. *(FSS(K+2)+FSS(K+10))
D     T3=48525.  *(FSS(K+3)+FSS(K+9))
D     T4=272400. *(FSS(K+4)+FSS(K+8))
D     T5=260550. *(FSS(K+5)+FSS(K+7))
D     T6=427368. *(FSS(K+6))
D     AT1=(5.*0.001)/299376.
D     AT2=T1+T2-T3+T4-T5+T6
D     A=AT1*AT2
      L=1002-I
      M=1002-I+1
```

```
D50   GS(L)=GS(M)+A
C
      DO 60 I=11,1001
      J= 1001-I
D     T1=16067.  *(FS (J+1)+FS (J+11))
D     T2=106300. *(FS (J+2)+FS (J+10))
D     T3=48525.  *(FS (J+3)+FS (J+9))
D     T4=272400. *(FS (J+4)+FS (J+8))
D     T5=260550. *(FS (J+5)+FS (J+7))
D     T6=427368. *(FS (J+6))
D     AT1=(5.*0.01 )/299376.
D     AT2=T1+T2-T3+T4-T5+T6
D     A=AT1*AT2
      K=1002-I
      L=1002-I+10
D60   GS(K)=GS(L)+A
C
C --- COMPUTE FLS
C
      DO 70  I=1,1001
D70   FLS(I)=FS(I) - T(I)*GS(I)
C
C --- WRITE FS,GS,FLS
C
      WRITE OUTPUT TAPE  8, 80,(FS(I),I=1,1001)
      WRITE OUTPUT TAPE  8, 80,(GS(I),I=1,1001)
      WRITE OUTPUT TAPE  8, 80,(FLS(I),I=1,1001)
   80 FORMAT (5E20.8)
C
C --- END
C
      END FILE 8
      PRINT 999
  999 FORMAT(20H1 DISMOUNT LOGICAL 8)
      PAUSE
      CALL EXIT
      END
```

B. Program for Printing Tables f_{S*}, G_{S*} and L_{S*}

```
C --- FS, GS, AND FLS EDIT AND PRINT
C
      PRINT 10
 10   FORMAT(30H1MOUNT INPUT TAPE ON LOGICAL 3)
      PRINT 15
 15   FORMAT(31H1MOUNT OUTPUT TAPE ON LOGICAL 8)
      PAUSE
C
      DIMENSION DIST(1001)
      DIMENSION T(11),TT(10)
      DIMENSION  P1(11),P2(11),P3(11),DIF(5)
      DIMENSION  IP3(11),ID(11)
      DIMENSION IP4(11)
C
 105  FORMAT(3I10)
 111  FORMAT(1H112X,1HFI3,41X,16HSTUDENT ORDINATE41X,1HFI3)
 112  FORMAT(1H112X,1HGI3,40X,18HSTUDENT RIGHT TAIL40X,4X)
 113  FORMAT(1H112X,4X,   40X,19HSTUDENT LINEAR LOSS39X,1HLI3)
 125  FORMAT( 18X,   78HEXP       0        1     2     3     4        5
     1   6     7     8     9      10)
 130  FORMAT(5E20.8)
 131  FORMAT(E20.8,4X)
 139  FORMAT(10X,6H   0.0I5,4X,I4,4X,I4,2X,I4,2X,I4,2X,I4,4X,I4,4X,I4,2X
     1,I4,2X,I4,2X,I4,4X,I4,2X,5I4)
 140  FORMAT(10X,F6.1,   I5,4X,I4,4X,I4,2X,I4,2X,I4,2X,I4,4X,I4,4X,I4,2X
     1,I4,2X,I4,2X,I4,4X,I4,2X,5I4)
 141  FORMAT(10X,F6.1,   I5,4X,I4,4X,I4,2X,I4,2X,I4,2X,I4,4X,I4,34X,
     1                    2X,5I4)
 142  FORMAT(10X,6X,     I5,4X,34X,                              I4,4X,I4,2X
     1,I4,2X,I4,2X,I4,4X,I4,2X,5I4)
 145  FORMAT(1H )
C
      READ INPUT TAPE 5,105,NUMNUS
      WRITE OUTPUT TAPE 6,105,NUMNUS
C
      DO 2000 IMAINA=1,NUMNUS
C
C --- ROUTINE FOR EACH NU
C
      READ INPUT TAPE 5,105,NU,LINSW,LINTOT
      WRITE OUTPUT TAPE 6,105,NU,LINSW,LINTOT
C
      DO 1800 IMAINB=1,3
C
      IF(IMAINB -2)211,212,213
 211  WRITE OUTPUT TAPE 8,111,NU,NU
      WRITE OUTPUT TAPE 8,145
      WRITE OUTPUT TAPE 8,125
      WRITE OUTPUT TAPE 8,145
      GO TO 230
 212  WRITE OUTPUT TAPE 8,112,NU,NU
      WRITE OUTPUT TAPE 8,145
      WRITE OUTPUT TAPE 8,125
      WRITE OUTPUT TAPE 8,145
      GO TO 230
 213  WRITE OUTPUT TAPE 8,113,NU,NU
      WRITE OUTPUT TAPE 8,145
```

```
      WRITE OUTPUT TAPE 8,125
      WRITE OUTPUT TAPE 8,145
      GO TO 230
C
C --- ROUTINE FOR EACH DISTRIBUTION
C
 230  READ INPUT TAPE  3,130,(DIST(I),I=1,1001)
      WRITE OUTPUT TAPE 6,105,IMAINA,NU,IMAINB
C
      ARG=0.0
      NL=1
      BN=10.**30
C
      ILINE=1
      DO 1000 IMAINC=1,80
C
      DO 240 JPR=1,11
      KPR=10*(IMAINC-1)+JPR
      P1(JPR)=DIST(KPR)
 240  CONTINUE
C
C --- DECISION 1 OR 2 LINES
C
      IF(ILINE-LINSW)300,600,600
C
C --- 1 LINE
C
 300  ILINE=ILINE+1
      A1=P1(1)*BN
      A2= .43429448 * LOGF(A1)
      I1=A2
      IE=(I1-30) +1
      IE2= XABSF (IE)
C
      IF(IE-0)330,320,310
C
  310 FMULT = 10.**(-IE2)
      DO 315 LPR=1,11
  315 P2(LPR)= P1(LPR)* FMULT
      GO TO 340
C
  320 DO 325 LPR=1,11
  325 P2(LPR)= P1(LPR)
      IE=+0
      GO TO 340
C
  330 FMULT =10.** IE2
      DO 335 LPR=1,11
  335 P2(LPR)=P1(LPR)*FMULT
      GO TO 340
C
  340 DO 345 J=1,11
  345 P3(J)=P2(J)* 10000.
      DO 360 J=1,11
      AX=P3(J)
      AY=P3(J)+1.
      IA=AY
```

```
      AZ=IA
      IF((AZ-AX)-(AY-AZ))350,350,355
  350 IP3(J)=AY
      GO TO 360
  355 IP3(J)=AX
      GO TO 360
  360 CONTINUE
C
      DIFT =0.
      DO 365 J=2,11
  365 DIFT=DIFT +( P3(J)-P3(J-1))
      DIFM=ABSF(DIFT/10.)
      DIF(1)=DIFM*.1
      DIF(2)=DIFM*.2
      DIF(3)=DIFM*.3
      DIF(4)=DIFM*.4
      DIF(5)=DIFM*.5
      DO 380 J=1,5
      AX=DIF(J)
      AY=DIF(J)+1.
      IA=AY
      AZ=IA
      IF((AZ-AX)-(AY-AZ))370,370,375
  370 ID(J)=AY
      GO TO 380
  375 ID(J)=AX
      GO TO 380
  380 CONTINUE
C
      DO 999 J=1,11
  999 IP4(J)=IP3(J)+10000
      IF(ARG-0.0)381,381,382
  381 WRITE OUTPUT TAPE 8,139,IE,      (IP4(J),J=1,11),(ID(J),J=1,5)
      GO TO 384
  382 WRITE OUTPUT TAPE 8, 140, ARG,IE,(IP4(J),J=1,11),(ID(J),J=1,5)
      GO TO 384
C
  384 NL=NL+1
      IF(NL-6)385,390,390
  385 GO TO 900
  390 WRITE OUTPUT TAPE 8, 145
      NL=1
      GO TO 900
C
C --- 2 LINE
C
  600 ILINE=ILINE+2
      I2L=1
      M=1
      MP=2
      N=6
      GO TO 630
C
  610 I2L=2
      M=6
      MP=7
      N=11
```

```
      GO TO 630
C
  630 A1=P1(M)*BN
      A2=.43429448*LOGF(A1)
      I1=A2
      IE=(I1-30)+1
      IE2=XABSF(IE)
C
      IF(IE-0)680,670,660
C
  660 FMULT=10.**(-IE2)
      DO 661 J=M,N
  661 P2(J)=P1(J)*FMULT
      GO TO 700
C
  670 DO 671 J=M,N
  671 P2(J)=P1(J)
      IE=+0
      GO TO 700
C
  680 FMULT=10.**IE2
      DO 681 J=M,N
  681 P2(J)=P1(J)*FMULT
      GO TO 700
C
  700 DO 710 J=M,N
  710 P3(J)=P2(J)*10000.
      DO 740 J=M,N
      AX=P3(J)
      AY=P3(J)+1.
      IA=AY
      AZ=IA
      IF((AZ-AX)-(AY-AZ))720,720,730
  720 IP3(J)=AY
      GO TO 740
  730 IP3(J)=AX
      GO TO 740
  740 CONTINUE
C
      DIFT=0.
      DO 750 J=MP,N
  750 DIFT=DIFT+(P3(J)-P3(J-1))
      DIFM=ABSF(DIFT/5.)
      DIF(1)=DIFM*.1
      DIF(2)=DIFM*.2
      DIF(3)=DIFM*.3
      DIF(4)=DIFM*.4
      DIF(5)=DIFM*.5
      DO 790 J=1,5
      AX=DIF(J)
      AY=DIF(J)+1.
      IA=AY
      AZ=IA
      IF((AZ-AX)-(AY-AZ))760,760,770
  760 ID(J)=AY
      GO TO 790
  770 ID(J)=AX
```

```
      GO TO 790
 790  CONTINUE
C
      GO TO (801,806),I2L
C
 801  DO 802 J=1,6
 802  IP4(J)=IP3(J)+10000
      WRITE OUTPUT TAPE 8,141,ARG,IE,(IP4(J),J=1,6),(ID(J),J=1,5)
      GO TO 610
C
 806  DO 807 J=6,11
 807  IP4(J)=IP3(J)+10000
      WRITE OUTPUT TAPE 8,142,IE,     (IP4(J),J=6,11),(ID(J),J=1,5)
      NL=NL+1
      IF(NL-6)810,820,820
 810  GO TO 900
 820  WRITE OUTPUT TAPE 8,145
      NL=1
      GO TO 900
C
C --- DECISION ON END OF TABLE- INDEX ON LINES
C
 900  IF(ILINE-LINTOT)920,950,950
 920  ARG=ARG+0.1
      GO TO 1000
 950  ARG=ARG+0.1
      GO TO 1050
C
 1000 CONTINUE
C
C --- LAST VALUE IN DISTRIBUTION
C
 1050 A1=P1(11)*BN
      A2= .43429448 * LOGF(A1)
      I1= A2
      IE=(I1-30) + 1
      IE2= XABSF(IE)
C
      IF(IE-0)1070,1060,1070
 1060 IE=0
      PL1=P1(11)
      GO TO 1080
 1070 PL1=P1(11) * (10.** IE2)* 10000.
      GO TO 1080
C
 1080 AX=PL1
      AY=PL1 + 1.
      IA=AY
      AZ=IA
      IF ((AZ-AX)-(AY-AZ)) 1085,1085,1090
 1085 IPL=AY
      GO TO 1100
 1090 IPL=AX
      GO TO 1100
C
 1100 WRITE OUTPUT TAPE 8, 140, ARG,IE,IPL
C
```

```
C --- MAIN INDEXES
C
 1800 CONTINUE
 2000 CONTINUE
C
      END FILE 8
      PRINT 3000
 3000 FORMAT(25H1DISMOUNT LOGICAL 3 AND 8)
      PAUSE
      CALL EXIT
      END
```

C.1 Evaluation of $B(\frac{1}{2},\frac{1}{2}\nu)$

```
C --- SERIES EXPANSION FOR B(1/2,1/2NU)
C
      DIMENSION RT(2),IR(2),GRT(2),GR(2)
C
 5    FORMAT(I10)
 10   FORMAT(E40.20,I10)
 20   FORMAT(E40.20)
 25   FORMAT(1H )
C
      SQPI=SQRTF(3.1415926535897932385)
      PRINT 20,SQPI
C
      READ 5,NUMB
      DO 1000 IMAIN=1,NUMB
C
      READ 10,FLNU,NZ
      PRINT 10,FLNU,NZ
      X=.5*FLNU
C
      IX=X
      TIX=IX
      R=X-TIX
      IF(R-.5)130,140,140
 130  RT(1)=R+1.
      IR(1)=IX-1
      RT(2)=R+.5
      IR(2)=IX
      GO TO 200
 140  RT(1)=R
      IR(1)=IX
      RT(2)=R+.5
      IR(2)=IX
      GO TO 200
C
 200  DO 400 I=1,2
      IF(RT(I)-1.)250,225,250
 225  GRT(I)=1.
      GO TO 400
 250  ZT=0.
      Z1=1.
      DO 300 J=1,NZ
      FJ=J
      READ INPUT TAPE 2,10,ZETA
      Z1=(1.-RT(I))*Z1
      Z=(Z1*ZETA)/FJ
 300  ZT=ZT+Z
      GRT(I)=EXPF(ZT)
      REWIND 2
 400  CONTINUE
      PRINT 20,GRT(1),GRT(2)
C
      DO 600 I=1,2
      GR(I)=GRT(I)
      RMULT=RT(I)
C
      IRT=IR(I)
      DO 500 J=1,IRT
```

```
      GR(I)=GR(I)*RMULT
      RMULT=RMULT+1.
  500 CONTINUE
C
  600 CONTINUE
C
      BETA=(SQPI*GR(1))/GR(2)
C
      PRINT 20,GR(1),GR(2),BETA
      PRINT 25
C
 1000 CONTINUE
      END
```

C.2 Finite Series Expansion for $G_{S*}(t;\nu)$, Integral Even ν < ∞

```
C --- SERIES EXPANSION FOR GS, INTEGRAL EVEN NU
C --- FS, GS, AND FLS
C
 10   FORMAT(I10)
 17   FORMAT(I10,E30.20,F10.2)
 18   FORMAT(E30.20)
 19   FORMAT(1H )
C
      READ 10,NUMNUS
      PRINT10,NUMNUS
      DO 450 INU=1,NUMNUS
C
      READ 17,NU,BETA,T
      PRINT17,NU,BETA,T
      FLNU=NU
C
C --- DENSITY FS
C
      Z=(1./SQRTF(FLNU))*(1./BETA)
      EXP=(-.5)*(FLNU+1.)
      FS=Z*(1.+T**2/FLNU)**EXP
      PRINT 18,FS
C
C --- RIGHT TAIL GS
C
      IMAX=NU/2
      CONA=FLNU/(FLNU+T**2)
      TERMU=1.
      SUMU=1.
C
      DO 440 I=2,IMAX
      FI=I
      TINCR=(2.*FI-3.)/(2.*FI-2.)
      TERMU=TINCR*CONA*TERMU
      SUMU=SUMU+TERMU
 440  CONTINUE
C
      CONB=T/SQRTF(FLNU+T**2)
      GS=.5*(1.-CONB*SUMU)
      PRINT 18,GS
C
C --- LINEAR LOSS FLS
C
      FLS=((FLNU+T**2)/(FLNU-1.))*FS - T*GS
      PRINT 18,FLS
      PRINT 19
C
 450  CONTINUE
      END
```

C.3 Finite Series Expansion for $G_{S*}(t|\nu)$, Integral Odd $\nu < \infty$

```
C --- SERIES EXPANSION FOR GS, INTEGRAL ODD NU
C --- FS, GS, AND FLS
C
 17   FORMAT(I10,E30.20,F10.2)
 18   FORMAT(E30.20)
C
 21   READ 17,NU,BETA,T
      PRINT17,NU,BETA,T
      FLNU=NU
C
C --- DENSITY FS
C
      Z=(1./SQRTF(FLNU))*(1./BETA)
      EXP=(-.5)*(FLNU+1.)
      FS=Z*(1.+T**2/FLNU)**EXP
      PRINT 18,FS
C
C --- RIGHT TAIL GS
C
      IMAX=(NU-1)/2
      CONA=FLNU/(FLNU+T**2)
      IF(NU-3)410,415,420
 410  SUMV=0.
      GO TO 490
 415  SUMV=CONA
      GO TO 490
 420  TERM=CONA
      SUMV=CONA
C
      DO 480 I=2,IMAX
      FI=I
      TINCR=(2.*FI-2.)/(2.*FI-1.)
      TERM=TINCR*CONA*TERM
      SUMV=SUMV+TERM
 480  CONTINUE
C
C --- ARCTAN OF SQRTF(FLNU/T)
C
 490  X=SQRTF(FLNU)/T
      PI=3.1415926535897932385
C
      IF(X-1.5)491,491,496
C
 491  CON1=X**2/(1.+X**2)
      TERM=1.
      SUM=1.
      SUMB4=1.
C
      DO 493 I=2,100
      FI=I
      TINCR=(2.*FI-2.)/(2.*FI-1.)
      TERM=TINCR*CON1*TERM
      SUM=SUM+TERM
      IF(SUM-SUMB4)494,494,492
 492  SUMB4=SUM
 493  CONTINUE
 494  CON2=X/(1.+X**2)
```

```
      ATANX=CON2*SUM
      GO TO 510
C
 496  CON1=1./X**2
      TERM=1./X
      SUM=1./X
      SUMB4=0.
C
      DO 498 I=2,100
      FI=I
      TINCR=-((2.*FI-3.)/(2.*FI-1.))
      TERM=TINCR*CON1*TERM
      SUM=SUM+TERM
      IF(SUM-SUMB4)497,499,497
 497  SUMB4=SUM
 498  CONTINUE
 499  ATANX=PI/2.-SUM
      GO TO 510
C
 510  PRINT 18,X,ATANX
      CONB=T/SQRTF(FLNU)
      GS=(1./PI)*(ATANX-CONB*SUMV)
      PRINT 18,GS
C
C --- LINEAR LOSS FLS
C
      FLS=((FLNU+T**2)/(FLNU-1.))*FS - T*GS
      PRINT 18,FLS
C
      GO TO 21
      END
```

C.4 Infinite Series Expansion for $G_{S*}(t|\nu)$, Real $\nu < \infty$, $t^2 < \nu$

```
C --- SERIES EXPANSION FOR GS, NU REAL, CONVERGES FOR T**2 LESS THAN NU
C --- FS, GS, AND FLS
C
 10   FORMAT(I10)
 17   FORMAT(2E30.20,F10.4)
 18   FORMAT( E30.20,I5)
 19   FORMAT(1H )
C
      READ 10, NUMNUS
      PRINT10, NUMNUS
      DO 500 INU=1,NUMNUS
C
      READ 17,TNU,TBETA,T
      PRINT17,TNU,TBETA,T
C
C --- DENSITY FS
C
      Z=(1./SQRTF(TNU))*(1./TBETA)
      EXP=(-.5)*(TNU+1.)
      FS=Z*(1.+T**2/TNU)**EXP
      PRINT 17,FS
C
C --- RIGHT TAIL GS
C
      CONA=T**2/TNU
      TERM=1.
      SUM=1.
      SUMB4=0.
C
      DO 340 J=2,500
      FJ=J
      TINCR=-((2.*FJ-3.)*(TNU+2.*FJ-3.))/((2.*FJ-1.)*(2.*FJ-2.))
      TERM=TINCR*CONA*TERM
      SUM=SUM+TERM
      IF(SUM-SUMB4)338,345,338
 338  SUMB4=SUM
 340  CONTINUE
      GO TO 999
C
 345  CONB=(T/SQRTF(TNU))/TBETA
      GS=.5-CONB*SUM
C
      PRINT 18,GS,J
C
C --- LINEAR LOSS FLS
C
      FLS=((TNU+T**2)/(TNU-1.))*FS - T*GS
      PRINT 17,FLS
      PRINT 19
C
 999  CONTINUE
 500  CONTINUE
      END
```

C.5 Infinite Series Expansion for $G_{S*}(t|\nu)$, Real $\nu < \infty$, $t^2 > \nu$

```
C --- SERIES EXPANSION FOR GS, NU REAL, CONVERGES AS POWER SERIES IN
C --- NU/(NU+T**2)   FS, GS, AND FLS
C
 10   FORMAT(I10)
 17   FORMAT(2E30.20,F10.3)
 18   FORMAT( E30.20,I5)
 19   FORMAT(1H )
C
      READ 10, NUMNUS
      PRINT10, NUMNUS
      DO 500 INU=1,NUMNUS
C
      READ 17,TNU,TBETA,T
      PRINT17,TNU,TBETA,T
C
C --- DENSITY FS
C
      Z=(1./SQRTF(TNU))*(1./TBETA)
      EXP=(-.5)*(TNU+1.)
      FS=Z*(1.+T**2/TNU)**EXP
      PRINT 17,FS
C
C --- RIGHT TAIL GS
C
      CONA=TNU/(TNU+T**2)
      TERM=1./TNU
      SUM= 1./TNU
      SUMB4=0.
C
      DO 340 J=2,500
      FJ=J
      TINCR=((2.*FJ-3.)*(TNU+2.*FJ-4.))/((2.*FJ-2.)*(TNU+2.*FJ-2.))
      TERM=TINCR*CONA*TERM
      SUM=SUM+TERM
      IF(SUM-SUMB4)345,345,338
 338  SUMB4=SUM
 340  CONTINUE
      GO TO 999
C
 345  CONB=(1./TBETA)*CONA**(.5*TNU)
      GS=CONB*SUM
      PRINT 18,GS,J
C
C --- LINEAR LOSS FLS
C
      FLS=((TNU+T**2)/(TNU-1.))*FS - T*GS
      PRINT 17,FLS
      PRINT 19
C
 500  CONTINUE
 999  CONTINUE
      END
```

C.6 Continued Fraction for $G_{S*}(t|\nu = \infty)$, $t > 2$

```
C --- NORMAL RIGHT TAIL USING LAPLACE SERIES, T GREATER THAN 2
C
 1     FORMAT(I10,E40.20)
 2     FORMAT(E40.20)
C
       READ 1,NUMB
       DO 200 IMAIN=1,NUMB
C
       READ 1,N,T
       AN=N
       Z=AN/(T+AN+1.)
       NM1=N-1
       DO 100 I=1,NM1
       AI=I
 100   Z=(AN-AI)/(T+Z)
       PI=3.1415926535897392
       F=(EXPF(-.5*T**2))/SQRTF(2.*PI)
       G=F/(T+Z)
       PRINT 2,G
       GNBS=1.-2.*G
       PRINT 2,GNBS
C
 200   CONTINUE
       END
```

C.7 Series Expansion for $G_{S*}(t|\nu = \infty)$, $t \leq 2$

```
C --- NORMAL RIGHT TAIL, T EQUAL TO OR LESS THAN 2
C
 10   FORMAT(I10,F10.2)
 20   FORMAT(E40.20)
C
      READ 10,NUMB
      PRINT10,NUMB
      DO 300 IMAIN=1,NUMB
C
      READ 10,ITER,T
      PRINT10,ITER,T
      PI=3.1415926535897932
      CON=1./(SQRTF(2.*PI))
      SUMB4=0.
      TERM=T
      SUM=T
      DO 100 I=1,ITER
       AI=I
      TINCR=-(2.*AI-1.)/(2.*AI*(2.*AI+1.))
      TERM=TINCR*TERM*T**2
      SUMB4=SUM
      SUM=SUM+TERM
      IF(SUM-SUMB4)100,150,100
  100 CONTINUE
  150 G = .5-(SUM*CON)
      PRINT 10,I
      PRINT 20,G
C
 300  CONTINUE
      END
```

D.1 R and Γ for $\nu = 1\frac{1}{2}, 2$

```
C --- OPTIMAL SAMPLE SIZE AND NET GAIN, NU=3/2,2
C
      PRINT 5
      PAUSE
C
C
      DIMENSION CL(121),CLGRHO(41,121),CLGNG(41,121)
      COMMON CL,CLGRHO,CLGNG
      DIMENSION PHIAS(121),PSIAS(121)
      COMMON PHIAS,PSIAS
C
D     DIMENSION FLNUT(19),STVT(19),BETAT(19)
D     DIMENSION T(1001), FS(1001),GS(1001),FLS(1001)
D     DIMENSION  TS(91),FSS(91)
      DIMENSION L(11)
      DIMENSION D( 41),THCTT( 41),THCT( 41),FLAMCT( 41),FLCT( 41)
      DIMENSION ATH(360),BL(121),BLAM(121)
      DIMENSION ALAM(360),CLAM(121),CTH(121)
      DIMENSION CRHOT(121),CRHO(121),ITER(121),CGPR(121)
      DIMENSION CRHOAS(121),RHORAT(121)
      DIMENSION CNG(121)
C
 5    FORMAT(38H1MOUNT OUTPUT TAPES ON LOGICAL 2 AND 8)
 6    FORMAT(25H1DISMOUNT LOGICAL 2 AND 8)
 10   FORMAT(3I10)
 15   FORMAT(5E20.8)
 16   FORMAT(5F20.8)
 21   FORMAT(1H1)
 22   FORMAT(1H )
 51   FORMAT(21HOSTUDENT DENSITY, NU=I4)
 52   FORMAT(24HOSTUDENT RIGHT TAIL, NU=I4)
 53   FORMAT(25HOSTUDENT LINEAR LOSS, NU=I4)
 61   FORMAT(110HO        CL                  CLAM                    CTH
     1            CRHO    CLGRHO                  CNG      CLGNG)
 63   FORMAT(70HO        CL                  CRHO                  CRHOAS
     X         RHORAT)
 71   FORMAT(F10.2,3E20.8,F10.4,E20.8,F10.4)
 72   FORMAT(F10.2,3E20.8,I10)
 73   FORMAT(F10.2,3E20.8)
 81   FORMAT(3HOD=F6.2)
C
C --- SPECIFY FLNUT, STVT, AND BETAT
C
      FLNUT(2)=1.5
      FLNUT(3)=2.
C
D     STVT(2)=0.11829 67755 68107 78653 E-01
D     STVT(3)= 0.4926228511662845E-02
C
D     BETAT(2)= 0.2396280469471184E+01
D     BETAT(3)= 0.2000000000000000E+01
C
C --- GENERATE T AND TS
C
      IT=0
D     T(1)=IT
      DO 110 I=2,1001
```

```
      IT= IT + 1
D     TT=IT
D 110 T(I) = TT/100.
C
      IT = 9910
D     TS(1)= IT/1000
      DO 115  I=2,91
      IT=IT+1
D     TT=IT
D 115 TS(I)=TT/1000.
C
C --- D LIST      0(.1)4
C
      ID = 0
      D(1)= ID
      DO 130 I=2,41
      ID=ID+1
      TD= ID
  130 D(I)= TD/10.
C
C --- ATH LIST  360 VALUES  .9999 9999 TO .01
C
      ATH(  1)=.9999 9999
      ATH(  2)=.9999 9998
      ATH(  3)=.9999 9997
      ATH(  4)=.9999 9996
      ATH(  5)=.9999 9995
      ATH(  6)=.9999 9994
      ATH(  7)=.9999 9993
      ATH(  8)=.9999 9992
      ATH(  9)=.9999 9991
      ATH( 10)=.9999 999
      ATH( 11)=.9999 998
      ATH( 12)=.9999 997
      ATH( 13)=.9999 996
      ATH( 14)=.9999 995
      ATH( 15)=.9999 994
      ATH( 16)=.9999 993
      ATH( 17)=.9999 992
      ATH( 18)=.9999 991
      ATH( 19)=.9999 99
      ATH( 20)=.9999 98
      ATH( 21)=.9999 97
      ATH( 22)=.9999 96
      ATH( 23)=.9999 95
      ATH( 24)=.9999 94
      ATH( 25)=.9999 93
      ATH( 26)=.9999 92
      ATH( 27)=.9999 91
      ATH( 28)=.9999 9
      ATH( 29)=.9999 8
      ATH( 30)=.9999 7
      ATH( 31)=.9999 6
      ATH( 32)=.9999 5
      ATH( 33)=.9999 4
      ATH( 34)=.9999 3
      ATH( 35)=.9999 2
```

```
      ATH( 36)=.9999 1
      ATH( 37)=.9999
      DO 133 J=38,236
  133 ATH(J)=ATH(J-1)-.0001
      ATH(237)=.979
      DO 134 J=238,266
  134 ATH(J)=ATH(J-1)-.001
      ATH(267)=.94
      DO 135 J=268,360
  135 ATH(J)=ATH(J-1)-.01
C
      WRITE OUTPUT TAPE 6,15,(ATH(J),J=1,360)
      WRITE OUTPUT TAPE 6,16,(ATH(J),J=1,360)
C
C --- BL AND BLAM          L=-2.(.1)10
C
      LT=-20
      BL(1)=-2.
      BLAM(1)=.01
      DO 160 J=2,121
      LT=LT+1
      IF(LT - 0)155,150,155
  150 BL(J)= + 0
      GO TO 160
  155 FLT = LT
      BL(J)= FLT/10.
  160 BLAM(J) = 10.** BL(J)
C
C --- READ NUMNU  , MAIN INDEX ON NU - IOFNU
C
      READ INPUT TAPE 5,10,NUMNU
      WRITE OUTPUT TAPE 6,10,NUMNU
C
      DO 3000  IOFNU = 1,NUMNU
C
C --- READ INU, NU, AND MAXIT
C
      READ INPUT TAPE 5,10,INU,NU,MAXIT
      WRITE OUTPUT TAPE 6,10,INU,NU,MAXIT
C
D     FLNU=FLNUT(INU)
D     STV=STVT(INU)
D     BETA=BETAT(INU)
      WRITE OUTPUT TAPE 6,15,FLNU,STV,BETA
C
C --- INITIALIZE  CLGRHO AND CLGNG
C
      DO 200 I=1,41
      DO  190  J=1,121
      CLGRHO(I,J) = 0.
      CLGNG(I,J) =0.
  190 CONTINUE
  200 CONTINUE
C
C --- COMPUTE FS
C
D     TERM1= 1./(BETA*SQRTF(FLNU))
```

```
D      EXP=-((FLNU+1.)/2.)
C
       DO 230 I=1,1001
D 230  FS (I)=TERM1* ((1.+(T (I)**2)/FLNU)**EXP)
C
C --- COMPUTE GS
C
D      GS(1001) = STV
C
       DO 235 I=1,91
D 235  FSS(I)=TERM1* ((1.+(TS(I)**2)/FLNU)**EXP)
C
       DO 250 I=2,10
       J= 11-I
       K= 10*(J-1)
D      T1=16067.  *(FSS(K+1)+FSS(K+11))
D      T2=106300. *(FSS(K+2)+FSS(K+10))
D      T3=48525.  *(FSS(K+3)+FSS(K+9))
D      T4=272400. *(FSS(K+4)+FSS(K+8))
D      T5=260550. *(FSS(K+5)+FSS(K+7))
D      T6=427368. *(FSS(K+6))
D      AT1=(5.*0.001)/299376.
D      AT2=T1+T2-T3+T4-T5+T6
D      A=AT1*AT2
       L=1002-I
       M=1002-I+1
D 250  GS(L)=GS(M)+A
C
       DO 260 I=11,1001
       J= 1001-I
D      T1=16067.  *(FS (J+1)+FS (J+11))
D      T2=106300. *(FS (J+2)+FS (J+10))
D      T3=48525.  *(FS (J+3)+FS (J+9))
D      T4=272400. *(FS (J+4)+FS (J+8))
D      T5=260550. *(FS (J+5)+FS (J+7))
D      T6=427368. *(FS (J+6))
D      AT1=(5.*0.01 )/299376.
D      AT2=T1+T2-T3+T4-T5+T6
D      A=AT1*AT2
       K=1002-I
       L=1002-I+10
D 260  GS(K)=GS(L)+A
C
C --- COMPUTE FLS
C
D      BOT = FLNU-1.
       DO 270 I=1,1001
D 270  FLS(I)=((FLNU+ T(I)**2.)/BOT)*FS(I) - T(I)* GS(I)
C
C --- PRINT STUDENT DISTRIBUTIONS
C
       WRITE OUTPUT TAPE 6,51,NU
       WRITE OUTPUT TAPE 6,15,(FS (I),I=1,1001,100)
       WRITE OUTPUT TAPE 6,52,NU
       WRITE OUTPUT TAPE 6,15,(GS (I),I=1,1001,100)
       WRITE OUTPUT TAPE 6,53,NU
       WRITE OUTPUT TAPE 6,15,(FLS(I),I=1,1001,100)
```

```
C
C --- READ INDEX IOFD          INDEX ON D
C
      READ INPUT TAPE 5,10,IOFD1,IOFD2,IOFD3
      WRITE OUTPUT TAPE 6,10,IOFD1,IOFD2,IOFD3
C
      DO  2000  IOFD  = IOFD1,IOFD2,IOFD3
C
C --- READ AND PRINT THCT(IOFD), IOFL1,IOFL2,IOFL3
C
      READ INPUT TAPE 5,15,THCT(IOFD)
      READ INPUT TAPE 5,10,IOFL1,IOFL2,IOFL3
C
      WRITE OUTPUT TAPE 6,21
      WRITE OUTPUT TAPE 6,15,THCT(IOFD)
      WRITE OUTPUT TAPE 6,10,IOFL1,IOFL2,IOFL3
C
C --- COMPUTE  ALAM = F(ATH)  WHERE ATH = OR GREATER THAN THCT(IOFD) ,
C --- NOTE ATH IS STORED IN DECREASING ORDER
C
      DO 400 J=1,360
      IF(ATH(J)- THCT(IOFD))350,350,370
C
  350 JLONG=J-1
      GO TO 425
C
  370 DTH = D(IOFD)/ ATH(J)
      L(1)= XLOCF(L(1))
      L(2)= XLOCF(T(1))
      L(3)= XLOCF(FS(1))
      L(4)= 1
      L(5)= 1
      L(6)= 5
      L(7)= 1001
      L(8)= 0
      FSDTH = TABF(DTH,L(1))
      I=L(8)
      GO TO(390,375),I
C
  375 PRINT 380, IOFD, J, DTH
  380 FORMAT(15H1TFS(D/ATH) BAD2I5,E20.8)
      GO TO 9999
C
  390 TERM1=(FLNU-1.)/(FLNU+ DTH**2)
      TERM2=(2.* ATH(J)) / ((( 1.-ATH(J)**2 )**2 )* FSDTH)
      ALAM(J)= TERM1 * TERM2
  400 CONTINUE
      JLONG=360
C
C ---                          COMPUTE   CTH = F(CLAM) , WHERE
C --- CLAM = 10**L     , BY USING ALAM= F(ATH) TABLE
C
  425 DO 750 J=IOFL1,IOFL2,IOFL3
      CL(J)= BL(J)
      CLAM(J)= BLAM(J)
      L(1)= XLOCF( L(1))
      L(2)= XLOCF(ALAM(1))
```

```
      L(3)= XLOCF(ATH(1))
      L(4)=1
      L(5)=1
      L(6)=5
      L(7)= JLONG
      L(8)=0
      CTH(J)=  TABF(CLAM(J),L(1))
      GO TO (750,710 ),I
  710 PRINT 720, IOFD, J,CTH(J)
  720 FORMAT(16H1CTH=F(CLAM) BAD2I5,E20.8)
      GO TO 9999
C
  750 CONTINUE
C
C --- COMPUTE CRHOT
C
      DO 800 J=IOFL1,IOFL2,IOFL3
      CRHOT(J)= CTH(J)**2 / (1.- CTH(J)**2 )
  800 CONTINUE
C
C --- COMPUTE CRHO BY NEWTON RAPHSON
C
      DO 900 J=IOFL1,IOFL2,IOFL3
      RHONEW=CRHOT(J)
      AGPRN=0.
C
      DO 880 IT=1,MAXIT
      IF(IT-10)825,825,830
  825 RHO=RHONEW
      GO TO 850
  830 RHO=RHONEW
      IF(AGPRO-AGPRN)835,835,840
  835 GO TO 890
  840 GO TO 850
C
  850 AGPRO=AGPRN
      V=D(IOFD)
      FLAM=10.**CL(J)
      THETA=SQRTF(RHO/(1.+RHO))
      CON=1./(SQRTF(FLNU)*BETA)
      EXP=(-.5)*(FLNU+1.)
      DTH=V/THETA
      FSDTH=CON * (1.+DTH**2/FLNU)**EXP
      T1=(.5*FLAM) / (SQRTF(RHO*(RHO+1.)**3))
      T2=(FLNU+DTH**2) / (FLNU-1.)
      GPR=(T1*T2*FSDTH)-1.
      TA=FLAM/ (4.*(FLNU-1.))
      TB=SQRTF(RHO*(RHO+1.))
      TQA=-4.*(FLNU+V**2)*RHO**2
      TQB=(V**2*FLNU-6.*V**2-FLNU) * RHO
      TQC=V**2*(FLNU-2.)
      U1=TA/TB
      U2=(TQA+TQB+TQC)/(TB**2)
      G2PR=(U1*U2*FSDTH)/(TB**2)
      RHONEW=RHO - (GPR/G2PR)
      AGPRN=ABSF(GPR)
C
```

```
 880  CONTINUE
C
 890  CRHO(J)=RHONEW
      ITER(J)=IT
      CGPR(J)=GPR
C
 900  CONTINUE
C
C --- COMPUTE CLGRHO
C
      DO 950 J=IOFL1,IOFL2,IOFL3
      IF(CRHO(J)-0.)910,910,920
 910  CLGRHO(IOFD,J)=-99.9999
      GO TO 950
 920  CLGRHO(IOFD,J)=LOG10F(CRHO(J))
 950  CONTINUE
C
C --- COMPUTE  CNG,  CLGNG
C
      DO 1100 J=IOFL1,IOFL2,IOFL3
      DTH=D(IOFD)/CTH(J)
      IF(DTH-8.)1010,960,960
C
D960  TNU=FLNU
D     TBETA=BETA
D     H=DTH
C
C --- DENSITY FST
C
D     Z=(1./SQRTF(TNU))*(1./BETA)
D     EXP=(-.5)*(TNU+1.)
D     FST=Z*(1.+H**2/TNU)**EXP
C
C --- RIGHT TAIL GST
C
D     CONA=TNU/(TNU+T**2)
D     TERM=1./TNU
D     SUM= 1./TNU
D     SUMB4=0.
C
      DO 975 JK=2,500
D     FJ=JK
D     TINCR=((2.*FJ-3.)*(TNU+2.*FJ-4.))/((2.*FJ-2.)*(TNU+2.*FJ-2.))
D     TERM=TINCR*CONA*TERM
D     SUM=SUM+TERM
D     IF(SUM-SUMB4)980,980,970
D970  SUMB4=SUM
 975  CONTINUE
C
D980  CONB=(1./TBETA)*CONA**(.5*TNU)
D     GST=CONB*SUM
C
C --- LINEAR LOSS FLST
C
D     FLST=((TNU+H**2)/(TNU-1.))*FST-H*GST
C
D     FLSDTH=FLST
```

```
      GO TO 1050
C
 1010 L(1)= XLOCF( L(1))
      L(2)= XLOCF (T(1))
      L(3)= XLOCF(FLS(1))
      L(4)= 1
      L(5)= 1
      L(6)= 5
      L(7)= 1001
      L(8)= 0
      FLSDTH = TABF( DTH,L(1))
      I=L(8)
      GO TO (1050,1020),I
 1020 PRINT 1030, IOFD, J, FLSDTH
 1030 FORMAT(15H1FLSDTH     BAD2I5,E20.8)
      GO TO 9999
C
 1050 CLAMTT=CLAM(J)
D     CLAMT=CLAMTT
      CTHTT=CTH(J)
D     CTHT=CTHTT
      CRHOTT=CRHO(J)
D     CRHOT=CRHOTT
D     CNG(J)=CLAMT*CTHT*FLSDTH-CRHOT
      IF(CNG(J)-0.)1060,1060,1070
 1060 CLGNG(IOFD,J)= -99.9999
      GO TO 1100
 1070 CLGNG(IOFD,J)= LOG10F (CNG(J))
C
 1100 CONTINUE
C
C --- RHO ASYMPTOTIC CALCULATION FOR VARIOUS CLAM VALUES
C
      KOFD=(10*IOFD)-9
      FSOFD=FS(KOFD)
C
      CONST=(.5*((FLNU+D(IOFD)**2)/(FLNU-1.))*FSOFD)**.5
C
      DO 1600 J=IOFL1,IOFL2,IOFL3
 1600 CRHOAS(J)=CONST*CLAM(J)**.5
C
      DO 1650 J=IOFL1,IOFL2,IOFL3
 1650 RHORAT(J)=CRHO(J)/CRHOAS(J)
C
C --- WRITE MAIN FUNCTIONS ON TAPE 6
C
      WRITE OUTPUT TAPE  6,81,D(IOFD)
      WRITE OUTPUT TAPE  6,61
      WRITE OUTPUT TAPE 6,22
      WRITE OUTPUT TAPE  6,71,(CL(J),CLAM(J),CTH(J),CRHO(J),CLGRHO(IOFD,
     XJ),CNG(J),CLGNG(IOFD,J),J=IOFL1,IOFL2,IOFL3)
C
C --- WRITE CLGRHO AND CLGNG ON TAPE 2
C
      WRITE OUTPUT TAPE 2,15,(CLGRHO(IOFD,J),J=IOFL1,IOFL2,IOFL3)
      WRITE OUTPUT TAPE 2,15,(CLGNG(IOFD,J),J=IOFL1,IOFL2,IOFL3)
C
```

```
C --- WRITE CRHO FUNCTIONS ON TAPE 6
C
      WRITE OUTPUT TAPE 6,81,D(IOFD)
      WRITE OUTPUT TAPE 6,22
      WRITE OUTPUT TAPE 6,72,(CL(J),CRHOT(J),CRHO(J),CGPR(J),ITER(J),J=I
     XOFL1,IOFL2,IOFL3)
C
C --- WRITE ASYMPTOTIC CALCULATIONS ON TAPE 6
C
      WRITE OUTPUT TAPE 6,81,D(IOFD)
      WRITE OUTPUT TAPE 6,63
      WRITE OUTPUT TAPE 6,22
      WRITE OUTPUT TAPE 6,73,(CL(J),CRHO(J),CRHOAS(J),RHORAT(J),J=IOFL1
     X,IOFL2,IOFL3)
C
C --- COMPUTE PHI AND PSI FOR D
C
      PHIAS(IOFD)=.5 * LOG10F(.5*((FLNU+D(IOFD)**2)/(FLNU-1.))*FSOFD)
C
      FLSOFD=FLS(KOFD)
      PSIAS(IOFD)=LOG10F(FLSOFD)
      PSIAS(IOFD)=LOG10F(FLSOFD)
C
C --- INDEX ON D
C
 2000 CONTINUE
C
C --- WRITE SS AND NG, PLUS PHIAS AND PSIAS
C
      CALL WRSSNG(NU,CL,CLGRHO,CLGNG,PHIAS,PSIAS)
C
C --- INDEX ON NU
C
 3000 CONTINUE
C
 9999 CONTINUE
      END FILE 2
      END FILE 8
      REWIND 2
      REWIND 8
      PRINT 6
      PAUSE
      CALL EXIT
      END
```

D.2 R and Γ for $3 < \nu < \infty$

```
C --- OPTIMAL SAMPLE SIZE AND NET GAIN
C
      PRINT 5
      PAUSE
C
      DIMENSION CL(121),CLGRHO(41,121),CLGNG(41,121)
      COMMON CL,CLGRHO,CLGNG
      DIMENSION PHIAS(121),PSIAS(121)
      COMMON PHIAS,PSIAS
C
D     DIMENSION FLNUT(19),STVT(19),BETAT(19)
D     DIMENSION T(1001), FS(1001),GS(1001),FLS(1001)
D     DIMENSION  TS(91),FSS(91)
      DIMENSION L(11)
      DIMENSION D( 41),THCTT( 41),THCT( 41),FLAMCT( 41),FLCT( 41)
      DIMENSION ATH(360),BL(121),BLAM(121)
      DIMENSION ALAM(360),CLAM(121),CTH(121)
      DIMENSION CRHOT(121),CRHO(121),ITER(121),CGPR(121)
      DIMENSION CRHOAS(121),RHORAT(121)
      DIMENSION CNG(121)
C
 5    FORMAT(38H1MOUNT OUTPUT TAPES ON LOGICAL 2 AND 8)
 6    FORMAT(25H1DISMOUNT LOGICAL 2 AND 8)
 10   FORMAT(3I10)
 15   FORMAT(5E20.8)
 16   FORMAT(5F20.8)
 21   FORMAT(1H1)
 22   FORMAT(1H )
 51   FORMAT(21H0STUDENT DENSITY, NU=I4)
 52   FORMAT(24H0STUDENT RIGHT TAIL, NU=I4)
 53   FORMAT(25H0STUDENT LINEAR LOSS, NU=I4)
 61   FORMAT(110H0        CL                  CLAM                    CTH
     1            CRHO    CLGRHO                  CNG      CLGNG)
 63   FORMAT(70H0        CL                  CRHO                CRHOAS
     X         RHORAT)
 71   FORMAT(F10.2,3E20.8,F10.4,E20.8,F10.4)
 72   FORMAT(F10.2,3E20.8,I10)
 73   FORMAT(F10.2,3E20.8)
 81   FORMAT(3H0D=F6.2)
C
C --- SPECIFY FLNUT, STVT, AND BETAT
C
D     FLNUT(4)=3.
D     FLNUT(5)=4.
D     FLNUT(6)=5.
D     FLNUT(7)=6.
D     FLNUT(8)=7.
D     FLNUT(9)=8.
D     FLNUT(10)=9.
D     FLNUT(11)=10.
D     FLNUT(12)=12.
D     FLNUT(13)=15.
D     FLNUT(14)=20.
D     FLNUT(15)=24.
D     FLNUT(16)=30.
D     FLNUT(17)=40.
D     FLNUT(18)=60.
```

```
D      FLNUT(19)=120.
C
D      STVT(4)= 0.1064199529207075E-02
D      STVT(5)= 0.2810018113579956E-03
D      STVT(6)= 0.8547378787148180E-04
D      STVT(7)= 0.2895991377476813E-04
D      STVT(8)= 0.1069710144538641E-04
D      STVT(9)= 0.4244090763814246E-05
D      STVT(10)=0.1789118715962368E-05
D      STVT(11)=0.7947765877982060E-06
D      STVT(12)=0.1790661843836187E-06
D      STVT(13)=0.2498449071462472E-07
D      STVT(14)=0.1581890879357194E-08
D      STVT(15)=0.2457762763837653E-09
D      STVT(16)=0.2287625704114807E-10
D      STVT(17)=0.9656558502057788E-12
D      STVT(18)=0.1068842957337041E-13
D      STVT(19)=0.8569720587680508E-17
C
D      BETAT(4)= 0.1570796326794897E+01
D      BETAT(5)= 0.1333333333333333E+01
D      BETAT(6)= 0.1178097245096172E+01
D      BETAT(7)= 0.1066666666666667E+01
D      BETAT(8)= 0.9817477042468104E+00
D      BETAT(9)= 0.9142857142857143E+00
D      BETAT(10)=0.8590292412159591E+00
D      BETAT(11)=0.8126984126984127E+00
D      BETAT(12)=0.7738167388167388E+00
D      BETAT(13)=0.6580777580029401E+00
D      BETAT(14)=0.5675463855030419E+00
D      BETAT(15)=0.5170194816176779E+00
D      BETAT(16)=0.4614745534009741E+00
D      BETAT(17)=0.3988173068948810E+00
D      BETAT(18)=0.3249554203948302E+00
D      BETAT(19)=0.2293000137934539E+00
C
C --- GENERATE T AND TS
C
       IT=0
D      T(1)=IT
       DO 110 I=2,1001
       IT= IT + 1
D      TT=IT
D 110  T(I) = TT/100.
C
       IT = 9910
D      TS(1)= IT/1000
       DO 115  I=2,91
       IT=IT+1
D      TT=IT
D 115  TS(I)=TT/1000.
C
C --- D LIST      0(.1)4
C
       ID = 0
       D(1)= ID
       DO 130 I=2,41
```

```
      ID=ID+1
      TD= ID
  130 D(I)= TD/10.
C
C --- ATH LIST  360 VALUES  .9999 9999 TO .01
C
      ATH(  1)=.9999 9999
      ATH(  2)=.9999 9998
      ATH(  3)=.9999 9997
      ATH(  4)=.9999 9996
      ATH(  5)=.9999 9995
      ATH(  6)=.9999 9994
      ATH(  7)=.9999 9993
      ATH(  8)=.9999 9992
      ATH(  9)=.9999 9991
      ATH( 10)=.9999 999
      ATH( 11)=.9999 998
      ATH( 12)=.9999 997
      ATH( 13)=.9999 996
      ATH( 14)=.9999 995
      ATH( 15)=.9999 994
      ATH( 16)=.9999 993
      ATH( 17)=.9999 992
      ATH( 18)=.9999 991
      ATH( 19)=.9999 99
      ATH( 20)=.9999 98
      ATH( 21)=.9999 97
      ATH( 22)=.9999 96
      ATH( 23)=.9999 95
      ATH( 24)=.9999 94
      ATH( 25)=.9999 93
      ATH( 26)=.9999 92
      ATH( 27)=.9999 91
      ATH( 28)=.9999 9
      ATH( 29)=.9999 8
      ATH( 30)=.9999 7
      ATH( 31)=.9999 6
      ATH( 32)=.9999 5
      ATH( 33)=.9999 4
      ATH( 34)=.9999 3
      ATH( 35)=.9999 2
      ATH( 36)=.9999 1
      ATH( 37)=.9999
      DO 133 J=38,236
  133 ATH(J)=ATH(J-1)-.0001
      ATH(237)=.979
      DO 134 J=238,266
  134 ATH(J)=ATH(J-1)-.001
      ATH(267)=.94
      DO 135 J=268,360
  135 ATH(J)=ATH(J-1)-.01
C
      WRITE OUTPUT TAPE 6,15,(ATH(J),J=1,360)
      WRITE OUTPUT TAPE 6,16,(ATH(J),J=1,360)
C
C --- BL AND BLAM         L=-2.(.1)10
C
```

```
      LT=-20
      BL(1)=-2.
      BLAM(1)=.01
      DO 160 J=2,121
      LT=LT+1
      IF(LT - 0)155,150,155
  150 BL(J)= + 0
      GO TO 160
  155 FLT = LT
      BL(J)= FLT/10.
  160 BLAM(J) = 10.** BL(J)
C
C --- READ NUMNU  , MAIN INDEX ON NU - IOFNU
C
      READ INPUT TAPE 5,10,NUMNU
      WRITE OUTPUT TAPE 6,10,NUMNU
C
      DO 3000  IOFNU = 1,NUMNU
C
C --- READ INU, NU, AND MAXIT
C
      READ INPUT TAPE 5,10,INU,NU,MAXIT
      WRITE OUTPUT TAPE 6,10,INU,NU,MAXIT
C
D     FLNU=FLNUT(INU)
D     STV=STVT(INU)
D     BETA=BETAT(INU)
      WRITE OUTPUT TAPE 6,15,FLNU,STV,BETA
C
C --- INITIALIZE  CLGRHO AND CLGNG
C
      DO 200 I=1,41
      DO  190  J=1,121
      CLGRHO(I,J) = 0.
      CLGNG(I,J) =0.
  190 CONTINUE
  200 CONTINUE
C
C --- COMPUTE FS
C
D     TERM1= 1./(BETA*SQRTF(FLNU))
D     EXP=-((FLNU+1.)/2.)
C
      DO 230 I=1,1001
D 230 FS (I)=TERM1* ((1.+(T (I)**2)/FLNU)**EXP)
C
C --- COMPUTE GS
C
D     GS(1001) = STV
C
      DO 235 I=1,91
D 235 FSS(I)=TERM1* ((1.+(TS(I)**2)/FLNU)**EXP)
C
      DO 250 I=2,10
      J= 11-I
      K= 10*(J-1)
D     T1=16067.  *(FSS(K+1)+FSS(K+11))
```

```
D      T2=106300. *(FSS(K+2)+FSS(K+10))
D      T3=48525.  *(FSS(K+3)+FSS(K+9))
D      T4=272400. *(FSS(K+4)+FSS(K+8))
D      T5=260550. *(FSS(K+5)+FSS(K+7))
D      T6=427368. *(FSS(K+6))
D      AT1=(5.*0.001)/299376.
D      AT2=T1+T2-T3+T4-T5+T6
D      A=AT1*AT2
       L=1002-I
       M=1002-I+1
D 250  GS(L)=GS(M)+A
C
       DO 260 I=11,1001
       J= 1001-I
D      T1=16067.  *(FS (J+1)+FS (J+11))
D      T2=106300. *(FS (J+2)+FS (J+10))
D      T3=48525.  *(FS (J+3)+FS (J+9))
D      T4=272400. *(FS (J+4)+FS (J+8))
D      T5=260550. *(FS (J+5)+FS (J+7))
D      T6=427368. *(FS (J+6))
D      AT1=(5.*0.01 )/299376.
D      AT2=T1+T2-T3+T4-T5+T6
D      A=AT1*AT2
       K=1002-I
       L=1002-I+10
D 260  GS(K)=GS(L)+A
C
C --- COMPUTE FLS
C
D      BOT = FLNU-1.
       DO 270 I=1,1001
D 270  FLS(I)=((FLNU+ T(I)**2.)/BOT)*FS(I) - T(I)* GS(I)
C
C --- PRINT STUDENT DISTRIBUTIONS
C
       WRITE OUTPUT TAPE 6,51,NU
       WRITE OUTPUT TAPE 6,15,(FS (I),I=1,1001,100)
       WRITE OUTPUT TAPE 6,52,NU
       WRITE OUTPUT TAPE 6,15,(GS (I),I=1,1001,100)
       WRITE OUTPUT TAPE 6,53,NU
       WRITE OUTPUT TAPE 6,15,(FLS(I),I=1,1001,100)
C
C --- READ INDEX IOFD         INDEX ON D
C
       READ INPUT TAPE 5,10,IOFD1,IOFD2,IOFD3
       WRITE OUTPUT TAPE 6,10,IOFD1,IOFD2,IOFD3
C
       DO  2000  IOFD  = IOFD1,IOFD2,IOFD3
C
C --- READ AND PRINT THCT(IOFD), IOFL1,IOFL2,IOFL3
C
       READ INPUT TAPE 5,15,THCT(IOFD)
       READ INPUT TAPE 5,10,IOFL1,IOFL2,IOFL3
C
       WRITE OUTPUT TAPE 6,21
       WRITE OUTPUT TAPE 6,15,THCT(IOFD)
       WRITE OUTPUT TAPE 6,10,IOFL1,IOFL2,IOFL3
```

```
C
C --- COMPUTE  ALAM = F(ATH)  WHERE ATH = OR GREATER THAN THCT(IOFD) ,
C --- NOTE ATH IS STORED IN DECREASING ORDER
C
      DO 400 J=1,360
      IF(ATH(J)- THCT(IOFD))350,350,370
C
  350 JLONG=J-1
      GO TO 425
C
  370 DTH = D(IOFD)/ ATH(J)
      L(1)= XLOCF(L(1))
      L(2)= XLOCF(T(1))
      L(3)= XLOCF(FS(1))
      L(4)= 1
      L(5)= 1
      L(6)= 5
      L(7)= 1001
      L(8)= 0
      FSDTH = TABF(DTH,L(1))
      I=L(8)
      GO TO(390,375),I
C
  375 PRINT 380, IOFD, J, DTH
  380 FORMAT(15H1TFS(D/ATH) BAD2I5,E20.8)
      GO TO 9999
C
  390 TERM1=(FLNU-1.)/(FLNU+ DTH**2)
      TERM2=(2.* ATH(J)) / ((( 1.-ATH(J)**2 )**2 )* FSDTH)
      ALAM(J)= TERM1 * TERM2
  400 CONTINUE
      JLONG=360
C
C ---                          COMPUTE   CTH = F(CLAM) , WHERE
C --- CLAM = 10**L     , BY USING ALAM= F(ATH) TABLE
C
  425 DO 750 J=IOFL1,IOFL2,IOFL3
      CL(J)= BL(J)
      CLAM(J)= BLAM(J)
      L(1)= XLOCF( L(1))
      L(2)= XLOCF(ALAM(1))
      L(3)= XLOCF(ATH(1))
      L(4)=1
      L(5)=1
      L(6)=5
      L(7)= JLONG
      L(8)=0
      CTH(J)=  TABF(CLAM(J),L(1))
      GO TO (750,710 ),I
  710 PRINT 720, IOFD, J,CTH(J)
  720 FORMAT(16H1CTH=F(CLAM) BAD2I5,E20.8)
      GO TO 9999
C
  750 CONTINUE
C
C --- COMPUTE CRHOT
C
```

```
      DO 800 J=IOFL1,IOFL2,IOFL3
      CRHOT(J)= CTH(J)**2 / (1.- CTH(J)**2 )
  800 CONTINUE
C
C --- COMPUTE CRHO BY NEWTON RAPHSON
C
      DO 900 J=IOFL1,IOFL2,IOFL3
      RHONEW=CRHOT(J)
      AGPRN=0.
C
      DO 880 IT=1,MAXIT
      IF(IT-10)825,825,830
  825 RHO=RHONEW
      GO TO 850
  830 RHO=RHONEW
      IF(AGPRO-AGPRN)835,835,840
  835 GO TO 890
  840 GO TO 850
C
  850 AGPRO=AGPRN
      V=D(IOFD)
      FLAM=10.**CL(J)
      THETA=SQRTF(RHO/(1.+RHO))
      CON=1./(SQRTF(FLNU)*BETA)
      EXP=(-.5)*(FLNU+1.)
      DTH=V/THETA
      FSDTH=CON * (1.+DTH**2/FLNU)**EXP
      T1=(.5*FLAM) / (SQRTF(RHO*(RHO+1.)**3))
      T2=(FLNU+DTH**2) / (FLNU-1.)
      GPR=(T1*T2*FSDTH)-1.
      TA=FLAM/ (4.*(FLNU-1.))
      TB=SQRTF(RHO*(RHO+1.))
      TQA=-4.*(FLNU+V**2)*RHO**2
      TQB=(V**2*FLNU-6.*V**2-FLNU) * RHO
      TQC=V**2*(FLNU-2.)
      U1=TA/TB
      U2=(TQA+TQB+TQC)/(TB**2)
      G2PR=(U1*U2*FSDTH)/(TB**2)
      RHONEW=RHO - (GPR/G2PR)
      AGPRN=ABSF(GPR)
C
  880 CONTINUE
C
  890 CRHO(J)=RHONEW
      ITER(J)=IT
      CGPR(J)=GPR
C
  900 CONTINUE
C
C --- COMPUTE CLGRHO
C
      DO 950 J=IOFL1,IOFL2,IOFL3
      IF(CRHO(J)-0.)910,910,920
  910 CLGRHO(IOFD,J)=-99.9999
      GO TO 950
  920 CLGRHO(IOFD,J)=LOG10F(CRHO(J))
  950 CONTINUE
```

```
C
C --- COMPUTE  CNG,  CLGNG
C
 1000 DO 1100  J= IOFL1,IOFL2,IOFL3
      DTH=  D(IOFD)/ CTH(J)
      L(1)= XLOCF( L(1))
      L(2)= XLOCF (T(1))
      L(3)= XLOCF(FLS(1))
      L(4)= 1
      L(5)= 1
      L(6)= 5
      L(7)= 1001
      L(8)= 0
      FLSDTH = TABF( DTH,L(1))
      I=L(8)
      GO TO (1050,1020),I
 1020 PRINT 1030, IOFD, J, FLSDTH
 1030 FORMAT(15H1FLSDTH     BAD2I5,E20.8)
      GO TO 9999
C
 1050 CNG(J)= CLAM(J) * CTH(J) * FLSDTH - CRHO(J)
      IF(CNG(J)-0.)1060,1060,1070
 1060 CLGNG(IOFD,J)= -99.9999
      GO TO 1100
 1070 CLGNG(IOFD,J)= LOG10F (CNG(J))
C
 1100 CONTINUE
C
C --- RHO ASYMPTOTIC CALCULATION FOR VARIOUS CLAM VALUES
C
      KOFD=(10*IOFD)-9
      FSOFD=FS(KOFD)
C
      CONST=(.5*((FLNU+D(IOFD)**2)/(FLNU-1.))*FSOFD)**.5
C
      DO 1600 J=IOFL1,IOFL2,IOFL3
 1600 CRHOAS(J)=CONST*CLAM(J)**.5
C
      DO 1650 J=IOFL1,IOFL2,IOFL3
 1650 RHORAT(J)=CRHO(J)/CRHOAS(J)
C
C --- WRITE MAIN FUNCTIONS ON TAPE 6
C
      WRITE OUTPUT TAPE  6,81,D(IOFD)
      WRITE OUTPUT TAPE  6,61
      WRITE OUTPUT TAPE 6,22
      WRITE OUTPUT TAPE  6,71,(CL(J),CLAM(J),CTH(J),CRHO(J),CLGRHO(IOFD,
     XJ),CNG(J),CLGNG(IOFD,J),J=IOFL1,IOFL2,IOFL3)
C
C --- WRITE CLGRHO AND CLGNG ON TAPE 2
C
      WRITE OUTPUT TAPE 2,15,(CLGRHO(IOFD,J),J=IOFL1,IOFL2,IOFL3)
      WRITE OUTPUT TAPE 2,15,(CLGNG(IOFD,J),J=IOFL1,IOFL2,IOFL3)
C
C --- WRITE CRHO FUNCTIONS ON TAPE 6
C
      WRITE OUTPUT TAPE 6,81,D(IOFD)
```

```
      WRITE OUTPUT TAPE 6,22
      WRITE OUTPUT TAPE 6,72,(CL(J),CRHOT(J),CRHO(J),CGPR(J),ITER(J),J=I
     XOFL1,IOFL2,IOFL3)
C
C --- WRITE ASYMPTOTIC CALCULATIONS ON TAPE 6
C
      WRITE OUTPUT TAPE 6,81,D(IOFD)
      WRITE OUTPUT TAPE  6,63
      WRITE OUTPUT TAPE 6,22
      WRITE OUTPUT TAPE  6,73,(CL(J),CRHO(J),CRHOAS(J),RHORAT(J),J=IOFL1
     X,IOFL2,IOFL3)
C
C --- COMPUTE PHI AND PSI FOR D
C
      PHIAS(IOFD)=.5 * LOG10F(.5*((FLNU+D(IOFD)**2)/(FLNU-1.))*FSOFD)
C
      FLSOFD=FLS(KOFD)
      PSIAS(IOFD)=LOG10F(FLSOFD)
      PSIAS(IOFD)=LOG10F(FLSOFD)
C
C --- INDEX ON D
C
 2000 CONTINUE
C
C --- WRITE SS AND NG, PLUS PHIAS AND PSIAS
C
      CALL WRSSNG(NU,CL,CLGRHO,CLGNG,PHIAS,PSIAS)
C
C --- INDEX ON NU
C
 3000 CONTINUE
C
 9999 CONTINUE
      END FILE 2
      END FILE 8
      REWIND 2
      REWIND 8
      PRINT 6
      PAUSE
      CALL EXIT
      END
```

D.3 R and Γ for $\nu = \infty$

```
C --- OPTIMAL SAMPLE SIZE AND NET GAIN, NU=INF
C
      PRINT 5
      PAUSE
C
      DIMENSION CL(121),CLGRHO(41,121),CLGNG(41,121)
      COMMON CL,CLGRHO,CLGNG
      DIMENSION PHIAS(121),PSIAS(121)
      COMMON PHIAS,PSIAS
C
D     DIMENSION T(1001), FS(1001),GS(1001),FLS(1001)
D     DIMENSION  TS(91),FSS(91)
      DIMENSION L(11)
      DIMENSION D( 41),THCTT( 41),THCT( 41),FLAMCT( 41),FLCT( 41)
      DIMENSION ATH(360),BL(121),BLAM(121)
      DIMENSION ALAM(360),CLAM(121),CTH(121)
      DIMENSION CRHOT(121),CRHO(121),ITER(121),CGPR(121)
      DIMENSION CNG(121)
      DIMENSION CRHOAS(121),RHORAT(121)
C
 5    FORMAT(38H1MOUNT OUTPUT TAPES ON LOGICAL 2 AND 8)
 6    FORMAT(25H1DISMOUNT LOGICAL 2 AND 8)
 10   FORMAT(3I10)
 15   FORMAT(5E20.8)
 16   FORMAT(5F20.8)
 21   FORMAT(1H1)
 22   FORMAT(1H )
 51   FORMAT(21HOSTUDENT DENSITY, NU=I4)
 52   FORMAT(24HOSTUDENT RIGHT TAIL, NU=I4)
 53   FORMAT(25HOSTUDENT LINEAR LOSS, NU=I4)
 61   FORMAT(110HO        CL                    CLAM                    CTH
     1            CRHO    CLGRHO                      CNG      CLGNG)
 63   FORMAT(70HO        CL                  CRHO                CRHOAS
     X         RHORAT)
 71   FORMAT(F10.2,3E20.8,F10.4,E20.8,F10.4)
 72   FORMAT(F10.2,3E20.8,I10)
 73   FORMAT(F10.2,3E20.8)
 81   FORMAT(3HOD=F6.2)
C
C --- NU=999
C
      NU=999
C
C --- GENERATE T AND TS
C
      IT=0
D     T(1)=IT
      DO 110 I=2,1001
      IT= IT + 1
D     TT=IT
D110  T(I) = TT/100.
C
      IT = 9910
D     TS(1)= IT/1000
      DO 115  I=2,91
      IT=IT+1
D     TT=IT
```

```
D 115 TS(I)=TT/1000.
C
C --- D LIST      0(.1)4
C
      ID = 0
      D(1)= ID
      DO 130 I=2,41
      ID=ID+1
      TD= ID
  130 D(I)= TD/10.
C
C --- ATH LIST  360 VALUES  .9999 9999 TO .01
C
      ATH(  1)=.9999 9999
      ATH(  2)=.9999 9998
      ATH(  3)=.9999 9997
      ATH(  4)=.9999 9996
      ATH(  5)=.9999 9995
      ATH(  6)=.9999 9994
      ATH(  7)=.9999 9993
      ATH(  8)=.9999 9992
      ATH(  9)=.9999 9991
      ATH( 10)=.9999 999
      ATH( 11)=.9999 998
      ATH( 12)=.9999 997
      ATH( 13)=.9999 996
      ATH( 14)=.9999 995
      ATH( 15)=.9999 994
      ATH( 16)=.9999 993
      ATH( 17)=.9999 992
      ATH( 18)=.9999 991
      ATH( 19)=.9999 99
      ATH( 20)=.9999 98
      ATH( 21)=.9999 97
      ATH( 22)=.9999 96
      ATH( 23)=.9999 95
      ATH( 24)=.9999 94
      ATH( 25)=.9999 93
      ATH( 26)=.9999 92
      ATH( 27)=.9999 91
      ATH( 28)=.9999 9
      ATH( 29)=.9999 8
      ATH( 30)=.9999 7
      ATH( 31)=.9999 6
      ATH( 32)=.9999 5
      ATH( 33)=.9999 4
      ATH( 34)=.9999 3
      ATH( 35)=.9999 2
      ATH( 36)=.9999 1
      ATH( 37)=.9999
      DO 133 J=38,236
  133 ATH(J)=ATH(J-1)-.0001
      ATH(237)=.979
      DO 134 J=238,266
  134 ATH(J)=ATH(J-1)-.001
      ATH(267)=.94
      DO 135 J=268,360
```

```
  135  ATH(J)=ATH(J-1)-.01
C
      WRITE OUTPUT TAPE 6,15,(ATH(J),J=1,360)
      WRITE OUTPUT TAPE 6,16,(ATH(J),J=1,360)
C
C ---   BL AND BLAM          L=-2.(.1)10
C
      LT=-20
      BL(1)=-2.
      BLAM(1)=.01
      DO 160 J=2,121
      LT=LT+1
      IF(LT - 0)155,150,155
  150 BL(J)= + 0
      GO TO 160
  155 FLT = LT
      BL(J)= FLT/10.
  160 BLAM(J) = 10.** BL(J)
C
C --- INITIALIZE  CLGRHO AND CLGNG
C
      DO  200  I=1,41
      DO  190  J=1,121
      CLGRHO(I,J) = 0.
      CLGNG(I,J) =0.
  190 CONTINUE
  200 CONTINUE
C
C --- COMPUTE FS
C
D     CON=1./SQRTF(2.*3.141592653589793)
C
      DO 230 I=1,1001
D 230 FS(I)=CON*EXPF((-.5)*T(I)**2)
C
C --- COMPUTE GS
C
D     GS(1001)=.76198 53024 16059 16 E-23
C
      DO 235 I=1,91
D 235 FSS(I)=CON * EXPF((-.5)*TS(I)**2)
C
      DO 250 I=2,10
      J= 11-I
      K= 10*(J-1)
D     T1=16067.  *(FSS(K+1)+FSS(K+11))
D     T2=106300. *(FSS(K+2)+FSS(K+10))
D     T3=48525.  *(FSS(K+3)+FSS(K+9))
D     T4=272400. *(FSS(K+4)+FSS(K+8))
D     T5=260550. *(FSS(K+5)+FSS(K+7))
D     T6=427368. *(FSS(K+6))
D     AT1=(5.*0.001)/299376.
D     AT2=T1+T2-T3+T4-T5+T6
D     A=AT1*AT2
      L=1002-I
      M=1002-I+1
D 250 GS(L)=GS(M)+A
```

```
C
      DO 260 I=11,1001
      J= 1001-I
D     T1=16067.  *(FS (J+1)+FS (J+11))
D     T2=106300. *(FS (J+2)+FS (J+10))
D     T3=48525.  *(FS (J+3)+FS (J+9))
D     T4=272400. *(FS (J+4)+FS (J+8))
D     T5=260550. *(FS (J+5)+FS (J+7))
D     T6=427368. *(FS (J+6))
D     AT1=(5.*0.01 )/299376.
D     AT2=T1+T2-T3+T4-T5+T6
D     A=AT1*AT2
      K=1002-I
      L=1002-I+10
D 260 GS(K)=GS(L)+A
C
C --- COMPUTE FLS
C
      DO 270 I=1,1001
D 270 FLS(I)=FS(I)-T(I)*GS(I)
C
C --- PRINT DISTRIBUTIONS
C
      WRITE OUTPUT TAPE 6,51,NU
      WRITE OUTPUT TAPE 6,15,(FS (I),I=1,1001,100)
      WRITE OUTPUT TAPE 6,52,NU
      WRITE OUTPUT TAPE 6,15,(GS (I),I=1,1001,100)
      WRITE OUTPUT TAPE 6,53,NU
      WRITE OUTPUT TAPE 6,15,(FLS(I),I=1,1001,100)
C
C --- READ MAXIT
C
      READ INPUT TAPE 5,10,MAXIT
      WRITE OUTPUT TAPE 6,10,MAXIT
C
C --- READ INDEX IOFD         INDEX ON D
C
      READ INPUT TAPE 5,10,IOFD1,IOFD2,IOFD3
      WRITE OUTPUT TAPE 6,10,IOFD1,IOFD2,IOFD3
C
      DO  2000  IOFD  = IOFD1,IOFD2,IOFD3
C
C --- READ AND PRINT THCT(IOFD), IOFL1,IOFL2,IOFL3
C
      READ INPUT TAPE 5,15,THCT(IOFD)
      READ INPUT TAPE 5,10,IOFL1,IOFL2,IOFL3
C
      WRITE OUTPUT TAPE 6,21
      WRITE OUTPUT TAPE 6,15,THCT(IOFD)
      WRITE OUTPUT TAPE 6,10,IOFL1,IOFL2,IOFL3
C
C --- COMPUTE  ALAM = F(ATH)  WHERE ATH = OR GREATER THAN THCT(IOFD) ,
C --- NOTE ATH IS STORED IN DECREASING ORDER
C
      DO 400 J=1,360
      IF(ATH(J)- THCT(IOFD))350,350,370
C
```

```
 350  JLONG=J-1
      GO TO 425
C
 370  DTH=D(IOFD)/ATH(J)
      L(1)= XLOCF(L(1))
      L(2)= XLOCF(T(1))
      L(3)= XLOCF(FS(1))
      L(4)= 1
      L(5)= 1
      L(6)= 5
      L(7)= 1001
      L(8)= 0
      FSDTH=TABF(DTH,L(1))
      I=L(8)
      GO TO(390,375),I
C
  375 PRINT 380, IOFD, J, DTH
  380 FORMAT(15H1TFS(D/ATH) BAD2I5,E20.8)
      GO TO 9999
C
 390  TERM1=1.
      TERM2=(2.* ATH(J)) / ((( 1.-ATH(J)**2 )**2 )* FSDTH)
      ALAM(J)= TERM1 * TERM2
  400 CONTINUE
      JLONG=360
C
C ---                                  COMPUTE   CTH = F(CLAM) , WHERE
C --- CLAM = 10**L     , BY USING ALAM= F(ATH) TABLE
C
 425  DO 750 J=IOFL1,IOFL2,IOFL3
      CL(J)= BL(J)
      CLAM(J)= BLAM(J)
      L(1)= XLOCF( L(1))
      L(2)= XLOCF(ALAM(1))
      L(3)= XLOCF(ATH(1))
      L(4)=1
      L(5)=1
      L(6)=5
      L(7)= JLONG
      L(8)=0
      CTH(J)=  TABF(CLAM(J),L(1))
      GO TO (750,710 ),I
  710 PRINT 720, IOFD, J,CTH(J)
  720 FORMAT(16H1CTH=F(CLAM) BAD2I5,E20.8)
      GO TO 9999
C
  750 CONTINUE
C
C --- COMPUTE CRHOT
C
      DO 800 J=IOFL1,IOFL2,IOFL3
      CRHOT(J)= CTH(J)**2 / (1.- CTH(J)**2 )
 800  CONTINUE
C
C --- COMPUTE CRHO BY NEWTON RAPHSON
C
      DO 900 J=IOFL1,IOFL2,IOFL3
```

```
      RHONEW=CRHOT(J)
      AGPRN=0.
C
      DO 880 IT=1,MAXIT
      IF(IT-10)825,825,830
 825  RHO=RHONEW
      GO TO 850
 830  RHO=RHONEW
      IF(AGPRO-AGPRN)835,835,840
 835  GO TO 890
 840  GO TO 850
C
 850  AGPRO=AGPRN
      V=D(IOFD)
      FLAM=10.**CL(J)
      THETA=SQRTF(RHO/(1.+RHO))
      CON=1./SQRTF(2.*3.141592653589793)
      DTH=V/THETA
      FSDTH=CON*EXPF((-.5)*DTH**2)
      T1=(.5*FLAM) / (SQRTF(RHO*(RHO+1.)**3))
      T2=1.
      GPR=(T1*T2*FSDTH)-1.
      TA=FLAM/4.
      TB1=SQRTF(RHO*(RHO+1.))
      TB2=TB1**5
      TB=1./TB2
      TQ=((-4.)*RHO**2) + (V**2-1.)*RHO + V**2
      G2PR=TA*TB*FSDTH*TQ
      RHONEW=RHO - (GPR/G2PR)
      AGPRN=ABSF(GPR)
C
 880  CONTINUE
C
 890  CRHO(J)=RHONEW
      ITER(J)=IT
      CGPR(J)=GPR
C
 900  CONTINUE
C
C --- COMPUTE CLGRHO
C
      DO 950 J=IOFL1,IOFL2,IOFL3
      IF(CRHO(J)-0.)910,910,920
 910  CLGRHO(IOFD,J)=-99.9999
      GO TO 950
 920  CLGRHO(IOFD,J)=LOG10F(CRHO(J))
 950  CONTINUE
C
C --- COMPUTE  CNG,  CLGNG
C
 1000 DO 1100  J=  IOFL1,IOFL2,IOFL3
      DTH=D(IOFD)/CTH(J)
      L(1)= XLOCF( L(1))
      L(2)= XLOCF (T(1))
      L(3)= XLOCF(FLS(1))
      L(4)= 1
      L(5)= 1
```

```
      L(6)= 5
      L(7)= 1001
      L(8)= 0
      FLSDTH=TABF(DTH,L(1))
      I=L(8)
      GO TO (1050,1020),I
 1020 PRINT 1030, IOFD, J, FLSDTH
 1030 FORMAT(15H1FLSDTH     BAD2I5,E20.8)
      GO TO 9999
C
 1050 CNG(J)= CLAM(J) * CTH(J) * FLSDTH  -  CRHO(J)
      IF(CNG(J)-0.)1060,1060,1070
 1060 CLGNG(IOFD,J)= -99.9999
      GO TO 1100
 1070 CLGNG(IOFD,J)= LOG10F (CNG(J))
C
 1100 CONTINUE
C
C --- RHO ASYMPTOTIC CALCULATION FOR VARIOUS CLAM VALUES
C
      KOFD=(10*IOFD)-9
      FSOFD=FS(KOFD)
      DO 1600 J=IOFL1,IOFL2,IOFL3
 1600 CRHOAS(J)=SQRTF(.5*CLAM(J)*FSOFD)
C
      DO 1650 J=IOFL1,IOFL2,IOFL3
 1650 RHORAT(J)=CRHO(J)/CRHOAS(J)
C
C --- WRITE FUNCTIONS ON TAPE 6
C
      WRITE OUTPUT TAPE  6,81,D(IOFD)
      WRITE OUTPUT TAPE  6,61
      WRITE OUTPUT TAPE 6,22
      WRITE OUTPUT TAPE  6,71,(CL(J),CLAM(J),CTH(J),CRHO(J),CLGRHO(IOFD,
     XJ),CNG(J),CLGNG(IOFD,J),J=IOFL1,IOFL2,IOFL3)
C
C --- WRITE CLGRHO AND CLGNG ON TAPE 2
C
      WRITE OUTPUT TAPE 2,15,(CLGRHO(IOFD,J),J=IOFL1,IOFL2,IOFL3)
      WRITE OUTPUT TAPE 2,15,(CLGNG (IOFD,J),J=IOFL1,IOFL2,IOFL3)
C
C --- WRITE CRHO FUNCTIONS
C
      WRITE OUTPUT TAPE 6,81,D(IOFD)
      WRITE OUTPUT TAPE 6,22
      WRITE OUTPUT TAPE 6,72,(CL(J),CRHOT(J),CRHO(J),CGPR(J),ITER(J),J=I
     XOFL1,IOFL2,IOFL3)
C
C --- WRITE ASYMPTOTIC CALCULATIONS ON TAPE 6
C
      WRITE OUTPUT TAPE 6,81,D(IOFD)
      WRITE OUTPUT TAPE  6,63
      WRITE OUTPUT TAPE 6,22
      WRITE OUTPUT TAPE  6,73,(CL(J),CRHO(J),CRHOAS(J),RHORAT(J),J=IOFL1
     X,IOFL2,IOFL3)
C
C --- COMPUTE PHI AND PSI FOR D
```

```
C
      PHIAS(IOFD)=.5*LOG10F(.5*FSOFD)
C
      FLSOFD=FLS(KOFD)
      PSIAS(IOFD)=LOG10F(FLSOFD)
C
C --- INDEX ON D
C
 2000 CONTINUE
C
C --- WRITE SS AND NG, PLUS PHIAS AND PSIAS
C
      CALL WRSSNG(NU,CL,CLGRHO,CLGNG,PHIAS,PSIAS)
C
C --- END
C
 9999 CONTINUE
      END FILE 2
      END FILE 8
      REWIND 2
      REWIND 8
      PRINT 6
      PAUSE
      CALL EXIT
      END
```

D.4 Subprogram for Printing R and Γ.

```
C --- OPTIMAL SAMPLE SIZE AND NET GAIN EDIT AND PRINT
C
      SUBROUTINE WRSSNG (NU,CL,CLGRHO,CLGNG,PHIAS,PSIAS)
C
      DIMENSION CL(121),CLGRHO(41,121),CLGNG(41,121)
      COMMON CL,CLGRHO,CLGNG
      DIMENSION PHIAS(121),PSIAS(121)
      COMMON PHIAS,PSIAS
C
 16   FORMAT(3I10)
 36   FORMAT(1H )
 84   FORMAT(F10.1,2X,11F9.4)
 85   FORMAT(1H16X,2HSSI3,34X,19HOPTIMAL SAMPLE SIZE)
 86   FORMAT(1H150X,8HNET GAIN48X,2HNGI3)
 87   FORMAT(1H016X,3H0.06X,3H0.26X,3H0.46X,3H0.66X,3H0.86X,3H1.06X,3H1.
     X26X,3H1.46X,3H1.66X,3H1.86X,3H2.0)
 88   FORMAT(1H016X,3H2.06X,3H2.26X,3H2.46X,3H2.66X,3H2.86X,3H3.06X,3H3.
     X26X,3H3.46X,3H3.66X,3H3.86X,3H4.0)
 95   FORMAT(10H        PHI2X,11F9.4)
 96   FORMAT(10H        PSI2X,11F9.4)
C
C --- WRITE SS AND NG
C
      READ INPUT TAPE 5,16,LP1,LP2,LP3
      WRITE OUTPUT TAPE 6,16,LP1,LP2,LP3
C
C --- SS FIRST PAGE
C
      WRITE OUTPUT TAPE    8, 85, NU
      WRITE OUTPUT TAPE    8, 87
      WRITE OUTPUT TAPE    8, 36
C
      DO  2200  I=LP1,LP2,LP3
C
      WRITE OUTPUT TAPE   8,84,CL(I),(CLGRHO(J,I), J=1,21,2 )
C
      IF( I-21)2200, 2150, 2026
 2026 IF( I-26)2200, 2150, 2031
 2031 IF( I-31)2200, 2150, 2036
 2036 IF( I-36)2200, 2150, 2041
 2041 IF( I-41)2200, 2150, 2046
 2046 IF( I-46)2200, 2150, 2051
 2051 IF( I-51)2200, 2150, 2056
 2061 IF( I-61)2200, 2150, 2066
 2066 IF( I-66)2200, 2150, 2071
 2071 IF( I-71)2200, 2150, 2076
 2076 IF( I-76)2200, 2150, 2081
 2081 IF( I-81)2200, 2150, 2086
 2086 IF( I-86)2200, 2150, 2091
 2091 IF( I-91)2200, 2150, 2096
 2096 IF( I-96)2200, 2150, 2200
C
 2150 WRITE OUTPUT TAPE    8, 36
C
 2200 CONTINUE
C
      WRITE OUTPUT TAPE    8, 36
```

```
      WRITE OUTPUT TAPE    8, 36
      WRITE OUTPUT TAPE 8,95,(PHIAS(J),J=1,21,2)
C
C --- NG FIRST PAGE
C
      WRITE OUTPUT TAPE    8, 86, NU
      WRITE OUTPUT TAPE    8, 87
      WRITE OUTPUT TAPE     8, 36
C
      DO 2400 I=LP1,LP2,LP3
C
      WRITE OUTPUT TAPE   8, 84, CL(I),(CLGNG(J,I),J=1,21,2)
C
      IF( I-21)2400, 2350, 2226
 2226 IF( I-26)2400, 2350, 2231
 2231 IF( I-31)2400, 2350, 2236
 2236 IF( I-36)2400, 2350, 2241
 2241 IF( I-41)2400, 2350, 2246
 2246 IF( I-46)2400, 2350, 2251
 2251 IF( I-51)2400, 2350, 2256
 2256 IF( I-56)2400, 2350, 2261
 2261 IF( I-61)2400, 2350, 2266
 2266 IF( I-66)2400, 2350, 2271
 2271 IF( I-71)2400, 2350, 2276
 2276 IF( I-76)2400, 2350, 2281
 2281 IF( I-81)2400, 2350, 2286
 2286 IF( I-86)2400, 2350, 2291
 2291 IF( I-91)2400, 2350, 2296
 2296 IF( I-96)2400, 2350, 2400
C
 2350 WRITE OUTPUT TAPE    8, 36
C
 2400 CONTINUE
C
      WRITE OUTPUT TAPE    8, 36
      WRITE OUTPUT TAPE    8, 36
      WRITE OUTPUT TAPE 8,96,(PSIAS(J),J=1,21,2)
C
C --- WRITE SS AND NG, SECOND PAGE
C
      READ INPUT TAPE5,16,LP1,LP2,LP3
      WRITE OUTPUT TAPE 6,16,LP1,LP2,LP3
C
C --- SS SECOND PAGE
C
      WRITE OUTPUT TAPE    8, 85, NU
      WRITE OUTPUT TAPE    8,88
      WRITE OUTPUT TAPE     8, 36
C
      DO 2600  I= LP1,LP2,LP3
C
      WRITE OUTPUT TAPE    8, 84,CL(I),(CLGRHO(J,I), J=21,41,2)
C
      IF (I- 21)2600, 2550, 2426
 2426 IF (I- 26)2600, 2550, 2431
 2431 IF (I- 31)2600, 2550, 2436
 2436 IF (I- 36)2600, 2550, 2441
```

```
 2441 IF (I- 41)2600, 2550, 2446
 2446 IF (I- 46)2600, 2550, 2451
 2451 IF (I- 51)2600, 2550, 2456
 2456 IF (I- 56)2600, 2550, 2461
 2461 IF (I- 61)2600, 2550, 2466
 2466 IF (I- 66)2600, 2550, 2471
 2471 IF (I- 71)2600, 2550, 2476
 2476 IF (I- 76)2600, 2550, 2481
 2481 IF (I- 81)2600, 2550, 2486
 2486 IF (I- 86)2600, 2550, 2491
 2491 IF (I- 91)2600, 2550, 2496
 2496 IF (I- 96)2600, 2550, 2501
 2501 IF(I-101)2600,2550,2506
 2506 IF(I-106)2600,2550,2511
 2511 IF(I-111)2600,2550,2516
 2516 IF(I-116)2600,2550,2600
C
 2550 WRITE OUTPUT TAPE    8, 36
C
 2600 CONTINUE
C
      WRITE OUTPUT TAPE    8, 36
      WRITE OUTPUT TAPE    8, 36
      WRITE OUTPUT TAPE 8,95,(PHIAS(J),J=21,41,2)
C
C --- NG  SECOND PAGE
C
      WRITE OUTPUT TAPE    8, 86, NU
      WRITE OUTPUT TAPE    8,88
      WRITE OUTPUT TAPE     8, 36
C
      DO  2800  I= LP1,LP2,LP3
C
      WRITE OUTPUT TAPE    8, 84, CL(I),(CLGNG(J,I),J=21,41,2)
C
      IF ( I- 21) 2800, 2750, 2626
 2626 IF ( I- 26) 2800, 2750, 2631
 2631 IF ( I- 31) 2800, 2750, 2636
 2636 IF ( I- 36) 2800, 2750, 2641
 2641 IF ( I- 41)2800, 2750, 2646
 2646 IF ( I- 46) 2800, 2750, 2651
 2651 IF ( I- 51) 2800, 2750, 2656
 2656 IF ( I- 56) 2800, 2750, 2661
 2661 IF ( I- 61) 2800, 2750, 2666
 2666 IF ( I- 66) 2800, 2750, 2671
 2671 IF ( I- 71) 2800, 2750, 2676
 2676 IF ( I- 76) 2800, 2750, 2681
 2681 IF ( I- 81) 2800, 2750, 2686
 2686 IF ( I- 86) 2800, 2750, 2691
 2691 IF ( I- 91) 2800, 2750, 2696
 2696 IF ( I- 96) 2800, 2750, 2701
 2701 IF(I-101)2800,2750,2706
 2706 IF(I-106)2800,2750,2711
 2711 IF(I-111)2800,2750,2716
 2716 IF(I-116)2800,2750,2800
C
 2750 WRITE OUTPUT TAPE    8, 36
```

```
C
 2800 CONTINUE
C
      WRITE OUTPUT TAPE    8, 36
      WRITE OUTPUT TAPE    8, 36
      WRITE OUTPUT TAPE 8,96,(PSIAS(J),J=21,41,2)
C
C --- END
C
      RETURN
      END
```

E.1 Λ_c and R_c for $\nu < \infty$

```
C --- CUTOFFS, NU LESS THAN INF
C
D     DIMENSION T(1001), FS(1001),GS(1001),FLS(1001)
D     DIMENSION TS(91),FSS(91)
D     DIMENSION FLNUT(19),STVT(19),BETAT(19)
C
      DIMENSION L(11)
      DIMENSION D(101),THCTT(101),THCT(101),FLAMCT(101),FLCT(101)
      DIMENSION RHOCT(101),RCT(101)
C
      DIMENSION  TH1(1001), D1(1001)
C
 10   FORMAT(7I10)
 25   FORMAT(5E20.8)
 30   FORMAT(1H1)
C
C --- SPECIFY CONSTANTS
C
D     FLNUT(3)=2.
D     FLNUT(4)=3.
D     FLNUT(5)=4.
D     FLNUT(6)=5.
D     FLNUT(7)=6.
D     FLNUT(8)=7.
D     FLNUT(9)=8.
D     FLNUT(10)=9.
D     FLNUT(11)=10.
D     FLNUT(12)=12.
D     FLNUT(13)=15.
D     FLNUT(14)=20.
D     FLNUT(15)=24.
D     FLNUT(16)=30.
D     FLNUT(17)=40.
D     FLNUT(18)=60.
D     FLNUT(19)=120.
C
D     STVT(3)= 0.49262285116628 45E-02
D     STVT(4)= 0.10641995292070 75E-02
D     STVT(5)= 0.28100181135799 56E-03
D     STVT(6)= 0.85473787871481 80E-04
D     STVT(7)= 0.28959913774768 13E-04
D     STVT(8)= 0.10697101445386 41E-04
D     STVT(9)= 0.42440907638142 46E-05
D     STVT(10)=0.17891187159623 68E-05
D     STVT(11)=0.79477658779820 60E-06
D     STVT(12)=0.17906618438361 87E-06
D     STVT(13)=0.24984490714624 72E-07
D     STVT(14)=0.15818908793571 94E-08
D     STVT(15)=0.24577627638376 53E-09
D     STVT(16)=0.22876257041148 07E-10
D     STVT(17)=0.96565585020577 88E-12
D     STVT(18)=0.10688429573370 41E-13
D     STVT(19)=0.85697205876805 08E-17
C
D     BETAT(3)= 0.20000000000000 00E+01
D     BETAT(4)= 0.15707963267948 97E+01
D     BETAT(5)= 0.13333333333333 33E+01
```

```
D      BETAT(6)= 0.1178097245096172E+01
D      BETAT(7)= 0.1066666666666667E+01
D      BETAT(8)= 0.9817477042468104E+00
D      BETAT(9)= 0.9142857142857143E+00
D      BETAT(10)=0.8590292412159591E+00
D      BETAT(11)=0.8126984126984127E+00
D      BETAT(12)=0.7738167388167388E+00
D      BETAT(13)=0.6580777580029401E+00
D      BETAT(14)=0.5675463855030419E+00
D      BETAT(15)=0.5170194816176779E+00
D      BETAT(16)=0.4614745534009741E+00
D      BETAT(17)=0.3988173068948810E+00
D      BETAT(18)=0.3249554203948302E+00
D      BETAT(19)=0.2293000137934539E+00
C
C --- GENERATE T AND TS
C
       IT=0
D      T(1)=IT
       DO 110 I=2,1001
       IT= IT + 1
D      TT=IT
D 110  T(I) = TT/100.
C
       IT = 9910
D      TS(1)= IT/1000
       DO 115  I=2,91
       IT=IT+1
D      TT=IT
D 115  TS(I)=TT/1000.
C
C --- D LIST      0(.1)10
C
       ID = 0
       D(1)= ID
       DO 130 I=2,101
       ID=ID+1
       TD= ID
  130  D(I)= TD/10.
C
C --- READ NUMNUS     SET UP MAIN INDEX IMAIN
C
       READ INPUT TAPE 5,10,NUMNUS
       WRITE OUTPUT TAPE 6,10,NUMNUS
C
       DO 4000 IMAIN=1,NUMNUS
C

C --- READ INU,NU,IOFD1,IOFD2,IOFD3
C
       READ INPUT TAPE 5,10,INU,NU,IOFD1,IOFD2,IOFD3
       WRITE OUTPUT TAPE 6,30
       WRITE OUTPUT TAPE 6,10,INU,NU,IOFD1,IOFD2,IOFD3
C
D      FLNU=FLNUT(INU)
D      STV=STVT(INU)
D      BETA=BETAT(INU)
```

```
C
C --- COMPUTE FS
C
D     TERM1= 1./(BETA*SQRTF(FLNU))
D     EXP=-((FLNU+1.)/2.)
C
      DO 230 I=1,1001
D 230 FS (I)=TERM1* ((1.+(T (I)**2)/FLNU)**EXP)
C
C --- COMPUTE GS
C
D     GS(1001) = STV
C
      DO 235 I=1,91
D 235 FSS(I)=TERM1* ((1.+(TS(I)**2)/FLNU)**EXP)
C
      DO 250 I=2,10
      J= 11-I
      K= 10*(J-1)
D     T1=16067.  *(FSS(K+1)+FSS(K+11))
D     T2=106300. *(FSS(K+2)+FSS(K+10))
D     T3=48525.  *(FSS(K+3)+FSS(K+9))
D     T4=272400. *(FSS(K+4)+FSS(K+8))
D     T5=260550. *(FSS(K+5)+FSS(K+7))
D     T6=427368. *(FSS(K+6))
D     AT1=(5.*0.001)/299376.
D     AT2=T1+T2-T3+T4-T5+T6
D     A=AT1*AT2
      L=1002-I
      M=1002-I+1
D 250 GS(L)=GS(M)+A
C
      DO 260 I=11,1001
      J= 1001-I
D     T1=16067.  *(FS (J+1)+FS (J+11))
D     T2=106300. *(FS (J+2)+FS (J+10))
D     T3=48525.  *(FS (J+3)+FS (J+9))
D     T4=272400. *(FS (J+4)+FS (J+8))
D     T5=260550. *(FS (J+5)+FS (J+7))
D     T6=427368. *(FS (J+6))
D     AT1=(5.*0.01 )/299376.
D     AT2=T1+T2-T3+T4-T5+T6
D     A=AT1*AT2
      K=1002-I
      L=1002-I+10
D 260 GS(K)=GS(L)+A
C
C --- COMPUTE FLS
C
D     BOT = FLNU-1.
      DO 270 I=1,1001
D 270 FLS(I)=((FLNU+ T(I)**2.)/BOT)*FS(I) - T(I)* GS(I)
C
C --- WRITE FS,GS,FLS
C
      WRITE OUTPUT TAPE 6,25,(FS(I),I=1,1001,100)
      WRITE OUTPUT TAPE 6,25,(GS(I),I=1,1001,100)
```

```
      WRITE OUTPUT TAPE 6,25,(FLS(I),I=1,1001,100)
C
C --- ROUTINE FOR COMPUTING THCTT,THCT,FLAMCT,FLCT,RHOCT,AND RCT
C
C --- DECISION FOR NU  ROUTINE
C
      IF(NU-2)290,290,300
C
C --- NU = 2
C
  290 DO 295 I=IOFD1,IOFD2,IOFD3
      THCT(I)= 0.
      FLAMCT(I)= 2.* D(I)
      IF(FLAMCT(I)-0.)293,293,291
  291 FLCT(I) = LOG10F(FLAMCT(I))
      GO TO 295
  293 FLCT(I)= -.99999999E+09
  295 RCT(I)=-0.99999999E+09
      GO TO 3000
C
C --- COMPUTE TH1 AND ASSOCIATED D1
C
  300 ASSIGN 310 TO ISW
      DO 330  I=1,1001
      PHI = T(I) * ((FLNU-1.)/(FLNU + T(I)**2)) * (GS(I)/FS(I))
      IF( PHI- .5) 330,330,305
  305 GO TO  ISW, (310,315)
  310 ASSIGN 315 TO ISW
      IFIRST = I
      LENGTH=1002-IFIRST
  315 TH1(I) = SQRTF (2.*PHI- 1.)
      D1(I) = TH1(I) * T(I)
  330 CONTINUE
C
      WRITE OUTPUT TAPE 6,10,IFIRST,LENGTH
      WRITE OUTPUT TAPE 6, 25,( D1(I),I=1,1001)
      WRITE OUTPUT TAPE 6, 25,(TH1(I),I=1,1001)
C
C --- COMPUTE THCTT BYINTERPOLATION IN  D1= F(TH1)  TABLE
C
      DO 450 J=IOFD1,IOFD2,IOFD3
      IF(J-1)350,350,360
  350 THCTT(J)=0.
      GO TO 425
  360 DT=D(J)
      DO 390 I=1,1001
      IF(DT-D1(I))370,380,390
  370 TA=DT-D1(I-1)
      TB=D1(I)-D1(I-1)
      THCTT(J)=TH1(I-1) + (TA/TB)*(TH1(I)-TH1(I-1))
      GO TO 425
  380 THCTT(J)=TH1(I)
      GO TO 425
  390 CONTINUE
      THCTT(J)=TH1(1001)
      GO TO 425
C
```

```
 425  WRITE OUTPUT TAPE 6,25,THCTT(J)
C
 450  CONTINUE
C
C --- USING THCTT  COMPUTE THCT BY NEWTON-RAPHSON
C
      DO  1500  J= IOFD1,IOFD2,IOFD3
      IND=0
      TI=D(J)/THCTT(J)
C
 1100 WRITE OUTPUT TAPE 6,1110,TI
 1110 FORMAT(E20.8)
      L(1)= XLOCF(L(1))
      L(2)= XLOCF(T(1))
      L(3)= XLOCF(GS(1))
      L(4)= 1
      L(5)= 1
      L(6)= 5
      L(7)= 1001
      L(8)= 0
      GOFTI = TABF( TI,L(1))
      I=L(8)
      GO TO (1140,1120),I
C
 1120 PRINT  1125, TI
 1125 FORMAT( 6H1G BADE20.8)
      GO TO 9999
C
 1140 L(1)=  XLOCF(L(1))
      L(2)=  XLOCF(T(1))
      L(3)=  XLOCF(FS(1))
      L(4)=  1
      L(5)=  1
      L(6)=  5
      L(7)=  1001
      L(8)=  0
      FOFTI= TABF(TI,L(1))
      I= L(8)
      GO TO  (1180,1160),I
C
 1160 PRINT 1165, TI
 1165 FORMAT (6H1F BADE20.8)
      GO TO 9999
C
 1180 QI = TI*((FLNU-1.)/(FLNU+ TI**2)) * (GOFTI /FOFTI)
      YI = QI - .5*(1. + (D(J)/TI)**2)
      QIPR=((FLNU-1.)/(FLNU+ TI**2)) *((FLNU/(FLNU+TI**2))*(1.+TI**2)*
     X (GOFTI/FOFTI)  - TI )
      YIPR=  QIPR+ ( D(J)**2 / TI**3)
      TINC=  TI - (YI/YIPR)
C
      IF(IND-0)1200,1200,1220
 1200 IND= 1
      TI = TINC
      GO TO 1100
C
 1220 IF( TINC- TI)1300,1300,1250
```

```
C
 1250 TI= TINC
      GO TO 1100
C
 1300 THCT(J) = D(J)/TI
      WRITE OUTPUT TAPE 6,1305
 1305 FORMAT(1H )
      WRITE OUTPUT TAPE 6,1310,THCT(J)
 1310 FORMAT(E20.8)
C
 1500 CONTINUE
C
C --- COMPUTE FLAMCT, FLCT USING  FS  TABLE
C
      DO 2500  J= IOFD1,IOFD2,IOFD
      DTH =  D(J) / THCT(J)
      L(1)=XLOCF(L(1))
      L(2)=XLOCF(T(1))
      L(3)=XLOCF(FS(1))
      L(4)=1
      L(5)=1
      L(6)=5
      L(7)= 1001
      L(8)= 0
      FSDTH = TABF(DTH,L(1))
      I= L(8)
      GO TO (2440,2420),I
C
 2420 PRINT2425,J,DTH
 2425 FORMAT ( 15H1FS(D/THCT) BADI4,E20.8)
      GO TO 9999
C
 2440 FLAMCA=(FLNU-1.)/(FLNU+DTH**2)
      FLAMCB     = (2.*THCT(J))/ (((1.-THCT(J)**2 )**2 )* FSDTH)
      FLAMCT(J)=FLAMCA*FLAMCB
      IF(FLAMCT(J)-0.)2450,2450,2445
 2445 FLCT(J) = LOG10F (FLAMCT(J))
      GO TO 2500
 2450 FLCT(J) = -.99999999E+09
C
 2500 CONTINUE
C
C --- COMPUTE RHO AND LOGRHO
C
      DO 2950 J=IOFD1,IOFD2,IOFD3
      RHOCT(J)=THCT(J)**2 /(1.-THCT(J)**2 )
      IF(RHOCT(J)-0.)2920,2920,2930
 2920 RCT(J)=-99.9999
      GO TO 2950
 2930 RCT(J)=LOG10F(RHOCT(J))
 2950 CONTINUE
C
C --- PRINT D, THCTT,THCT,FLCT,RCT
C
 3000 WRITE OUTPUT TAPE 6,3050,NU
 3050 FORMAT(4H1NU=I4)
      WRITE OUTPUT TAPE 6,3100
```

```
 3100 FORMAT(110H0        D                          THCTT
     X THCT                          FLCT                          RCT)
      DO 3200 J=IOFD1,IOFD2,IOFD3
      WRITE OUTPUT TAPE 6,3150,D(J),THCTT(J),THCT(J),FLCT(J),RCT(J)
 3150 FORMAT(F10.1,4E25.8)
 3200 CONTINUE
C
C --- BLANK OUT D1 AND TH1
C
      DO 3500 J=1,1001
      D1(J)=0.
      TH1(J)=0.
 3500 CONTINUE
C
C --- MAIN INDEX
C
 4000 CONTINUE
C
C --- END
C
 9999 CONTINUE
      CALL EXIT
      END
```

E.2 A_c and R_c for $\nu = \infty$

```
C --- CUTOFFS, NU=INF
C
D     DIMENSION T(1001), FS(1001),GS(1001),FLS(1001)
D     DIMENSION TS(91),FSS(91)
C
      DIMENSION L(11)
      DIMENSION D(101),THCTT(101),THCT(101),FLAMCT(101),FLCT(101)
      DIMENSION RHOCT(101),RCT(101)
C
      DIMENSION  TH1(1001), D1(1001)
C
 10   FORMAT(7I10)
 25   FORMAT(5E20.8)
 30   FORMAT(1H1)
C
C --- NU=999
C
      NU=999
C
C --- READ AND PRINT IOFD
C
      READ INPUT TAPE 5,10,IOFD1,IOFD2,IOFD3
      WRITE OUTPUT TAPE 6,10,IOFD1,IOFD2,IOFD3
C
C --- GENERATE T AND TS
C
      IT=0
D     T(1)=IT
      DO 110 I=2,1001
      IT= IT + 1
D     TT=IT
D 110 T(I) = TT/100.
C
      IT = 9910
D     TS(1)= IT/1000
      DO 115  I=2,91
      IT=IT+1
D     TT=IT
D 115 TS(I)=TT/1000.
C
C --- D LIST     0(.1)10
C
      ID = 0
      D(1)= ID
      DO 130 I=2,101
      ID=ID+1
      TD= ID
  130 D(I)= TD/10.
C
C --- COMPUTE FS
C
D     CON=1./SQRTF(2.*3.141592653589793)
C
      DO 230 I=1,1001
D 230 FS(I)=CON*EXPF((-.5)*T(I)**2)
C
C --- COMPUTE GS
```

```
C
D     GS(1001)=.76198 53024 16059 16 E-23
C
      DO 235 I=1,91
D 235 FSS(I)=CON*EXPF((-.5)*TS(I)**2)
C
      DO 250 I=2,10
      J= 11-I
      K= 10*(J-1)
D     T1=16067.  *(FSS(K+1)+FSS(K+11))
D     T2=106300. *(FSS(K+2)+FSS(K+10))
D     T3=48525.  *(FSS(K+3)+FSS(K+9))
D     T4=272400. *(FSS(K+4)+FSS(K+8))
D     T5=260550. *(FSS(K+5)+FSS(K+7))
D     T6=427368. *(FSS(K+6))
D     AT1=(5.*0.001)/299376.
D     AT2=T1+T2-T3+T4-T5+T6
D     A=AT1*AT2
      L=1002-I
      M=1002-I+1
D 250 GS(L)=GS(M)+A
C
      DO 260 I=11,1001
      J= 1001-I
D     T1=16067.  *(FS (J+1)+FS (J+11))
D     T2=106300. *(FS (J+2)+FS (J+10))
D     T3=48525.  *(FS (J+3)+FS (J+9))
D     T4=272400. *(FS (J+4)+FS (J+8))
D     T5=260550. *(FS (J+5)+FS (J+7))
D     T6=427368. *(FS (J+6))
D     AT1=(5.*0.01 )/299376.
D     AT2=T1+T2-T3+T4-T5+T6
D     A=AT1*AT2
      K=1002-I
      L=1002-I+10
D 260 GS(K)=GS(L)+A
C
C --- COMPUTE FLS
C
      DO 270 I=1,1001
D 270 FLS(I)=FS(I)-T(I)*GS(I)
C
C --- WRITE FS,GS,FLS
C
      WRITE OUTPUT TAPE 6,25,(FS(I),I=1,1001,100)
      WRITE OUTPUT TAPE 6,25,(GS(I),I=1,1001,100)
      WRITE OUTPUT TAPE 6,25,(FLS(I),I=1,1001,100)
C
C --- ROUTINE FOR COMPUTING THCTT,THCT,FLAMCT,FLCT,RHOCT,AND RCT
C
C --- COMPUTE TH1 AND ASSOCIATED D1
C
 300  ASSIGN 310 TO ISW
      DO 330  I=1,1001
      PHI=T(I)*(GS(I)/FS(I))
      IF( PHI- .5) 330,330,305
 305  GO TO  ISW, (310,315)
```

```
  310 ASSIGN 315 TO ISW
      IFIRST = I
      LENGTH=1002-IFIRST
  315 TH1(I) = SQRTF (2.*PHI- 1.)
      D1(I) = TH1(I) * T(I)
  330 CONTINUE
C
      WRITE OUTPUT TAPE 6,10,IFIRST,LENGTH
      WRITE OUTPUT TAPE 6, 25,( D1(I),I=1,1001)
      WRITE OUTPUT TAPE 6, 25,(TH1(I),I=1,1001)
C
C --- COMPUTE THCTT BYINTERPOLATION IN  D1= F(TH1)  TABLE
C
      DO 450 J=IOFD1,IOFD2,IOFD3
      IF(J-1)350,350,360
  350 THCTT(J)=0.
      GO TO 425
  360 DT=D(J)
      DO 390 I=1,1001
      IF(DT-D1(I))370,380,390
  370 TA=DT-D1(I-1)
      TB=D1(I)-D1(I-1)
      THCTT(J)=TH1(I-1) + (TA/TB)*(TH1(I)-TH1(I-1))
      GO TO 425
  380 THCTT(J)=TH1(I)
      GO TO 425
  390 CONTINUE
      THCTT(J)=TH1(1001)
      GO TO 425
C
  425 WRITE OUTPUT TAPE 6,25,THCTT(J)
C
  450 CONTINUE
C
C --- USING THCTT  COMPUTE THCT BY NEWTON-RAPHSON
C
      DO  1500  J= IOFD1,IOFD2,IOFD3
      IND=0
      TI=D(J)/THCTT(J)
C
 1100 WRITE OUTPUT TAPE 6,1110,TI
 1110 FORMAT(E20.8)
      L(1)= XLOCF(L(1))
      L(2)= XLOCF(T(1))
      L(3)= XLOCF(GS(1))
      L(4)= 1
      L(5)= 1
      L(6)= 5
      L(7)= 1001
      L(8)= 0
      GOFTI = TABF( TI,L(1))
      I=L(8)
      GO TO (1140,1120),I
C
 1120 PRINT  1125, TI
 1125 FORMAT( 6H1G BADE20.8)
      GO TO 9999
```

```
C
 1140 L(1)=  XLOCF(L(1))
      L(2)=  XLOCF(T(1))
      L(3)=  XLOCF(FS(1))
      L(4)=  1
      L(5)=  1
      L(6)=  5
      L(7)=  1001
      L(8)=  0
      FOFTI= TABF(TI,L(1))
      I= L(8)
      GO TO  (1180,1160),I
C
 1160 PRINT 1165, TI
 1165 FORMAT (6H1F BADE20.8)
      GO TO 9999
C
 1180 QI=TI*(GOFTI/FOFTI)
      YI = QI - .5*(1. + (D(J)/TI)**2)
      QIPR=(1.+TI**2) * (GOFTI/FOFTI) -TI
      YIPR=  QIPR+ ( D(J)**2 / TI**3)
      TINC=  TI - (YI/YIPR)
C
      IF(IND-0)1200,1200,1220
 1200 IND= 1
      TI = TINC
      GO TO 1100
C
 1220 IF( TINC- TI)1300,1300,1250
C
 1250 TI= TINC
      GO TO 1100
C
 1300 THCT(J) = D(J)/TI
      WRITE OUTPUT TAPE 6,1305
 1305 FORMAT(1H )
      WRITE OUTPUT TAPE 6,1310,THCT(J)
 1310 FORMAT(E20.8)
C
 1500 CONTINUE
C
C --- COMPUTE FLAMCT, FLCT USING  FS  TABLE
C
      DO 2500  J= IOFD1,IOFD2,IOFD3
      DTH=D(J)/THCT(J)
      L(1)=XLOCF(L(1))
      L(2)=XLOCF(T(1))
      L(3)=XLOCF(FS(1))
      L(4)=1
      L(5)=1
      L(6)=5
      L(7)= 1001
      L(8)= 0
      FSDTH=TABF(DTH,L(1))
      I= L(8)
      GO TO (2440,2420),I
C
```

```
 2420 PRINT2425,J,DTH
 2425 FORMAT ( 15H1FS(D/THCT) BADI4,E20.8)
      GO TO 9999
C
 2440 FLAMCA=1.
      FLAMCB    = (2.*THCT(J))/ (((1.-THCT(J)**2 )**2 )* FSDTH)
      FLAMCT(J)=FLAMCA*FLAMCB
      IF(FLAMCT(J)-0.)2450,2450,2445
 2445 FLCT(J) = LOG10F (FLAMCT(J))
      GO TO 2500
 2450 FLCT(J) = -.99999999E+09
C
 2500 CONTINUE
C
C --- COMPUTE RHO AND LOGRHO
C
      DO 2950 J=IOFD1,IOFD2,IOFD3
      RHOCT(J)=THCT(J)**2 /(1.-THCT(J)**2 )
      IF(RHOCT(J)-0.)2920,2920,2930
 2920 RCT(J)=-99.9999
      GO TO 2950
 2930 RCT(J)=LOG10F(RHOCT(J))
 2950 CONTINUE
C
C --- PRINT D, THCTT,THCT,FLCT,RCT
C
      WRITE OUTPUT TAPE 6,3050,NU
 3050 FORMAT(4H1NU=I4)
      WRITE OUTPUT TAPE 6,3100
 3100 FORMAT(110H0         D                          THCTT
     X THCT                          FLCT                          RCT)
      DO 3200 J=IOFD1,IOFD2,IOFD3
      WRITE OUTPUT TAPE 6,3150,D(J),THCTT(J),THCT(J),FLCT(J),RCT(J)
 3150 FORMAT(F10.1,4E25.8)
 3200 CONTINUE
C
C --- END
C
 9999 CONTINUE
      CALL EXIT
      END
```

F. Subprogram for Aitkens Interpolation (Modification of SHARE Distribution Number 355,408)

```
        FAP
        ENTRY TAB
        ENTRY XTAB
        REM X1 CONTAINS X WITH ADJUSTED SIGN
        REM COMMON-2 IS ERAS
        REM K NOT GREATER THAN 5
        REM COMMON CONTAINS X
        REM COMMON-1 CONTAIN LOC OF LIST
        REM COMMON FOR AUXILIARY
        REM XTABLE FLOATS FROM COMMON-8
        REM TO COMMON-8 WHEN K=5
        REM Y TABLE FLOATS FROM COMMON-9
        REM TO COMMON-14
        REM ON OV OR UNDER FLOW OR DCT
        REM ORIGINAL ARG IN ACC
        REM 1 LIST (8) IF SOLN IS GOOD
        REM 2 LIST (8) IF ERROR
        REM LIST (1)=LOCATION OF LIST (1)
        REM LIST (2)=LOCATION OF X TABLE
        REM LIST (3)=LOCATION OF Y TABLE
        REM LIST (4)=DEL X
        REM LIST (5)=DEL Y
        REM LIST (6)=K
        REM LIST (7)=P
        REM LIST (8)=1-SUCCESSFUL, 2-ERROR
J1      CLA 0,1                 A=LOC OF X TABLE
J2      NOP                     CHS IF X(I+1) LESS THAN X(I)
        CAS X1                  X1 HAS SIGN ADJUSTED
        TRA J9                  X LESS THAN X(I)
        TRA J9                  X=X(I)
J6      TXI J7,1,0              X GREATER THAN X(I), D=DELTA X
J7      TXI J8,2,0              D=DELTA Y
J8      TXL J1,1,0              KODD(P-(K+1)/2-1),KEVEN(P-(K/2+1)-1)
J9      CLA K2                  LOC OF K IN ADDRESS
        LBT
        TRA J13                 K EVEN
        TRA J26                 K ODD
J13     CLA 0,1                 A=LOC OF XTABLE
        FSB COMMON              LOCATION OF X
        SSP
        STO COMMON-2            ERASABLE
J17     TIX J18,1,0             D=DELTA X
J18     CLA 0,1                 A=LOC OF XTAB
        FSB COMMON
        SSP
        FSB COMMON-2
        TMI J25                 X CLOSER TO X(I)
J23     TXL J24,1,0             DECREMENT SAME AS J8      TAB 54.1
J23A    TIX J23B,1,0            DECR DELTAX               TAB 54.2
J23B    TIX J23,2,0             DECR DELTAY               TAB 54.3
J24     TXI J26,1,0             X CLOSER TO X(I+1)D=DELTA X
J25     TIX J26,2,0             D=DELTA Y
J26     TXI J27,1,0             -(K/2)DELTA X,-(K+1)/2 DELTA X
J27     TXI J28,2,0             -(K/2)DELTA Y,-(K+1)/2 DELTA Y
J28     LXD K1,4                K1=0,0, K+1
J29     CLA COMMON
J30     FSB 0,1                 A=LOC OF X TABLE
```

```
        STO  COMMON-2,4
J31     TXI  J32,1,0          D=DELTA X
J32     TIX  J29,4,1
        LXD  K1,4
J34     CLA  0,2              A=Y TABLE
        STO  COMMON-8,4
J36     TXI  J37,2,0          D=DELTA Y
J37     TIX  J34,4,1
        LXD  K,1              K=0,0,5
J39     DCT                   BEGIN AITKEN INTERPOLATION
J40     TOV  J41
J41     PXD  0,1
J42     PDX  0,2
J43     TOV  J44
J44     CLA  COMMON-2,2
        FSB  COMMON-3,1
        STO  COMMON-2         ERASE, X(I)-X(I+1)
        LDQ  COMMON-9,1
        FMP  COMMON-2,2
        STO  K1               ERASE, Y(I) (X-X(I+1))
        LDQ  COMMON-3,1
        FMP  COMMON-8,2
        CHS
        FAD  K1
        TOV  J67                                        TAB 53.1
        TQO  J54                                        TAB 53.2
J54     FDP  COMMON-2                                   TAB  54
        TQO  J67                                        TAB 54.1
        STQ  COMMON-8,2
        TIX  J43,2,1
        TIX  J41,1,1
        DCT
        TRA  J67              DIVIDE CHECK ON
        CLA  DONE             PREPARE NORMAL EXIT
J61     STO  0                A=LIST (8)
        CLA  COMMON-9
        LXD  REG1,1
        LXD  REG2,2
        LXD  REG4,4
        TRA  1,4
J67     CLA  COMMON           SET ERROR RETURN
        STO  COMMON-9
        CLA  DTWO
        TRA  J61
J71     SXD  REG1,1           ENTRY POINT FOR TABLE
        SXD  REG2,2
        SXD  REG4,4
        STO  COMMON           X
        STQ  COMMON-1         LOCATION OF LIST
        CLA  COMMON-1
        COM
        ADD  DONE
        PDX  0,4              2-COMPLEMENT OF LIST LOCATION
        CLA  -1,4             ADDRESS OF X TABLE
        ARS  18
        STA  J1
        STA  J13
```

```
        STA J18
        STA J30
        STA J137
        STA J139
        CLA -2,4
        ARS 18
        STA J34
        CLA -5,4
        STO K
        ADD DONE
        STO K1
        SUB DONE
        ARS 18
        STA K2
        CLA -3,4            ACC HAS DELTA X
        STD J6
        STD J17
        STD J24
        STD J31
        STD J23A                                        TAB137.1
        CLA -4,4            DELTA Y IN ACC
        STD J7
        STD J25
        STD J36
        STD J23B                                        TAB141.1
        LXD K,1
        LDQ DONE+1,1
        MPY -3,4
        ALS 17
        STO COMMON-2        (AK/2) DELTAX
        COM
        ADD DONE
        STD J26
        LDQ DONE+1,1
        MPY -4,4
        ALS 17
        STO COMMON-8        (AK/2)DELTAY, TEMP ERAS
        COM
        ADD DONE
        STD J27
        CLA K2
        LBT
        TRA J124            K EVEN
        TRA J130            K ODD
J124    CLA COMMON-2
        ADD -3,4
        STO COMMON-2
        CLA COMMON-8
        ADD -4,4
        STO COMMON-8
J130    CLA -6,4
        SUB DONE
        LRS 35
        MPY -3,4
        ALS 17
        SUB COMMON-2
        STD J8
```

```
                                                                  TAB173.1
        STD  J23
J137    CLA  0          A=XTAB,DETERMINE DIRECTION
        LXD  J17,1      OF MONOTONICITY
J139    FSB  0,1        X(1)-X(2)
        TPL  J144
        CLA  NOP
        STO  J2
        CLA  COMMON
        TRA  J148
J144    CLA  CHS
        STO  J2
        CLA  COMMON
        CHS
J148    STO  X1
        CLA  0,4
        SUB  SEVEN
        ARS  18
        STA  J61
        LXD  COMMON-2,1
        LXD  COMMON-8,2
        CLA  -6,4                                                 TAB154.1
        SUB  K1                                                   TAB154.2
        TNZ  J1                                                   TAB154.3
        PDX  0,1                                                  TAB154.4
        PDX  0,2                                                  TAB154.5
        TRA  J28                                                  TAB  155
J156    CLA  LOCATE
        TRA  1,4        LOCATING SUB ROUTINE
K       PZE  0,0,0      0,0,K
K1      PZE  0,0,0      0,0,K+1
K2      PZE  0,0,0      K,0,0
X1      PZE             X WITH ADJUSTED SIGN
        PZE  0,0,3
        PZE  0,0,2
DTWO    PZE  0,0,2
        PZE  0,0,1
DONE    PZE  0,0,1
NOP     NOP
CHS     CHS
SEVEN   PZE  0,0,7
REG1    PZE
REG2    PZE
REG4    PZE
LOCATE  PZE  0,0,J71
 TAB    SYN  J71
 XTAB   SYN  J156
        COMMON  -206
COMMON  COMMON  9
        END
```

G.1 Optimal Sample Size - First Search Procedure

```
C --- OPTIMAL SAMPLE SIZE - FIRST SEARCH PROCEDURE
C
 5     FORMAT(I10)
 10    FORMAT(F5.1,E30.20,2F5.2,I5)
 20    FORMAT(E40.20)
 30    FORMAT(1H )
C
       READ 5,NUMB
C
       DO 800 IMAIN=1,NUMB
C
 100   READ 10,FLNU,BETA,D,FL,MAXIT
C
       A=-4.*(FLNU+D**2)
       B=-((6.-FLNU)*D**2+FLNU)
       C=D**2*(FLNU-2.)
       RHOLO=(-B-SQRTF(B**2-(4.*A*C)))/(2.*A)
       FLAM=10.**FL
       CON=(FLNU**(.5*FLNU))/BETA
       EXP=-.5*(FLNU+1.)
       FSD=CON*(FLNU+D**2)**EXP
       RHOHI=SQRTF(.5*FLAM*FSD)
       PRINT 20,A,B,C,RHOLO,FLAM,CON,EXP,FSD,RHOHI
C
       DO 500 IT=1,MAXIT
       IF(IT-2)110,120,130
 110   RHO=RHOLO
       GO TO 150
 120   RHO=RHOHI
       GO TO 150
 130   RHO=RHOT
       GO TO 150
C
 150   THETA=SQRTF(RHO/(RHO+1.))
       FSDTH=CON*(FLNU+(D/THETA)**2)**EXP
       T1=(FLNU+(D/THETA)**2)*FSDTH/(FLNU-1.)
       T2=1./SQRTF(RHO*(RHO+1.)**3)
       GPR=(.5*FLAM*T1*T2)-1.
       PRINT 20,THETA,FSDTH ,T1,T2,GPR
C
       IF(IT-2)210,220,300
 210   RHOL=RHOLO
       GPRL=GPR
       GO TO 500
 220   RHOH=RHOHI
       GPRH=GPR
       GO TO 400
C
 300   IF(GPR-0.)310,320,330
 310   RHOH=RHOT
       GPRH=GPR
       GO TO 400
 320   RHOOP=RHOT
       PRINT 20,RHOOP,GPR
       GO TO 800
 330   RHOL=RHOT
       GPRL=GPR
```

```
      GO TO 400
C
 400  TOP=(GPRL*RHOH)-(GPRH*RHOL)
      BOT=GPRL-GPRH
      RHOT=TOP/BOT
      PRINT 20,TOP,BOT,RHOT
C
      RL=.43429448190325182765*LOGF(RHOL)
      RH=.43429448190325182765*LOGF(RHOH)
      RT=.43429448190325182765*LOGF(RHOT)
C
      PRINT 20,RHOL,GPRL,RHOH,GPRH,RHOT
      PRINT 20,RL,RH,RT
      PRINT 30
C
 500  CONTINUE
C
 800  CONTINUE
C
      END
```

G.2 Optimal Sample Size - Second Search Procedure

```
C --- OPTIMAL SAMPLE SIZE - SECOND SEARCH PROCEDURE
C
 5     FORMAT(I10)
 10    FORMAT(F5.1,E30.20,2F5.2,I5)
 20    FORMAT(3E40.20)
 30    FORMAT(1H )
C
       READ 5,NUMB
C
       DO 1000 IMAIN=1,NUMB
C
       READ 10,FLNU,BETA,D,FL,MAXIT
       PRINT10,FLNU,BETA,D,FL,MAXIT
C
       A=-4.*(FLNU+D**2)
       B=-((6.-FLNU)*D**2+FLNU)
       C=D**2*(FLNU-2.)
       RHOLO=(-B-SQRTF(B**2-(4.*A*C)))/(2.*A)
       FLAM=10.**FL
       CON=(FLNU**(.5*FLNU))/BETA
       EXP=-.5*(FLNU+1.)
       FSD=CON*(FLNU+D**2)**EXP
       RHOHI=SQRTF(.5*FLAM*(FLNU+D**2)*FSD/(FLNU-1.))
       PRINT 20,A,B,C,RHOLO,FLAM,CON,EXP,FSD,RHOHI
C
       I310=0
       I330=0
       DO 500 IT=1,MAXIT
       IF(IT-2)110,120,130
 110   RHO=RHOLO
       GO TO 150
 120   RHO=RHOHI
       GO TO 150
 130   RHO=RHOT
       GO TO 150
C
 150   THETA=SQRTF(RHO/(RHO+1.))
       FSDTH=CON*(FLNU+(D/THETA)**2)**EXP
       T1=(FLNU+(D/THETA)**2)*FSDTH/(FLNU-1.)
       T2=1./SQRTF(RHO*(RHO+1.)**3)
       GPR=(.5*FLAM*T1*T2)-1.
       PRINT 20,GPR
C
       IF(IT-2)210,220,300
 210   RHOL=RHOLO
       IF(GPR-0.)212,212,214
 212   RHOT=0.
       GO TO 900
 214   GPRL=GPR
       GPLB4=GPR
       GO TO 500
 220   RHOH=RHOHI
       GPRH=GPR
       GPHB4=GPR
       GO TO 400
C
 300   IF(GPR-0.)310,400,330
```

```
 310  RHOH=RHOT
      GPRH=GPR
      IF(GPRH-GPHB4)900,900,315
 315  GPHB4=GPRH
      I310=I310+1
      I330=0
      IF(I310-3)400,450,450
 330  RHOL=RHOT
      GPRL=GPR
      IF(GPLB4-GPRL)900,900,335
 335  GPLB4=GPRL
      I330=I330+1
      I310=0
      IF(I330-3)400,450,450
C
 400  RHOT=((GPRL*RHOH)-(GPRH*RHOL))/(GPRL-GPRH)
      PRINT 20,RHOL,RHOH,RHOT
      PRINT 30
      GO TO 900
C
 450  RHOT=.5*(RHOH+RHOL)
      PRINT 20,RHOL,RHOH,RHOT
      PRINT 30
      I310=0
      I330=0
      GO TO 500
C
 500  CONTINUE
C
 900  RT=.434294481903251827 65*LOGF(RHOT)
      PRINT 20,GPR
      PRINT 20,RHOL,RHOH
      PRINT 20,RHOT,RT
      PRINT 5,IT
C
 1000 CONTINUE
      END
```

G.3 Optimal Sample Size - Newton-Raphson Procedure

```
C --- OPTIMAL SAMPLE SIZE - NEWTON-RAPHSON PROCEDURE
C
 10   FORMAT(2E30.20)
 15   FORMAT(1H )
C
      READ 10,FLNU,BETA
      PRINT10,FLNU,BETA
      READ 10,D,FL
      PRINT10,D,FL
      READ 10,RCT
      PRINT10,RCT
      RHONEW=10.**RCT
      PRINT 10,RHONEW
C
      DO 500 IMAIN=1,15
      RHO=RHONEW
C
      FLAM=10.**FL
      THETA=SQRTF(RHO/(1.+RHO))
      CON=1./(SQRTF(FLNU)*BETA)
      EXP=(-.5)*(FLNU+1.)
      DTH=D/THETA
      FSDTH=CON * (1.+DTH**2/FLNU)**EXP
      TA=(.5*FLAM) / (SQRTF(RHO*(RHO+1.)**3))
      TB=(FLNU+DTH**2) / (FLNU-1.)
      GPR=(TA*TB*FSDTH)-1.
      TA=FLAM/ (4.*(FLNU-1.))
      TB=1./SQRTF((RHO*(RHO+1.))**5.)
      TQA=-4.*(FLNU+D**2)*RHO**2
      TQB=(D**2*FLNU-6.*D**2-FLNU) * RHO
      TQC=D**2*(FLNU-2.)
      G2PR=TA*TB*FSDTH* (TQA+TQB+TQC)
      PRINT 10,FLAM,THETA,CON,EXP,DTH,FSDTH,TA,TB,TQA,TQB,TQC,G2PR
C
      RHONEW=RHO - (GPR/G2PR)
      RCTNEW=.43429 44819 03251 82765 * LOGF(RHONEW)
C
      PRINT 10,GPR,G2PR
      PRINT 10,RHONEW,RCTNEW
      PRINT 15
C
 500  CONTINUE
      END
```

G.4 Net Gain for Given Optimal Sample Size, Real $\nu < \infty$, $t^2 < \infty$

```
C --- NET GAIN FOR GIVEN OPTIMAL SAMPLE SIZE, REAL NU, CONVERGES AS
C --- POWER SERIES IN NU/(NU+T**2)
C
 10   FORMAT(I10)
 17   FORMAT(2E30.20,F10.4)
 18   FORMAT(2E30.20,I5)
 19   FORMAT(1H )
C
      READ 17,TNU,TBETA
      PRINT17,TNU,TBETA
      READ 17,TD,TL
      PRINT17,TD,TL
      PRINT 19
 1    READ 17,TRHO
      PRINT 17,TRHO
C
C --- TFLAM,TTHET,T
C
      TFLAM=10.**TL
      TTHET=SQRTF(TRHO/(TRHO+1.))
      T=TD/TTHET
C
C --- DENSITY FS
C
      Z=(1./SQRTF(TNU))*(1./TBETA)
      EXP=(-.5)*(TNU+1.)
      FS=Z*(1.+T**2/TNU)**EXP
      PRINT 17,FS
C
C --- RIGHT TAIL GS
C
      EPS=.1E-10 * 10.**(-T)
C
      FRAC=T**2/TNU
      CON= SQRTF(FRAC) / TBETA
      DELTA= EPS/CON
      SUM=1
      TERM=1
C
      DO 240 J=2,1000
      FJ=J
      TINCR= -((2.*FJ-3.)/(2.*FJ-1.)) * (1./(FJ-1.))
     X       *(.5*(TNU+2.*FJ-3.))
      TERM= TERM*TINCR*FRAC
      SUM=TERM+SUM
      ERFAC=ABSF(TERM)
      IF(ERFAC -DELTA) 245,240,240
  240 CONTINUE
      GO TO 999
C
 245  GS=.5-CON*SUM
C
      PRINT 18,GS,EPS,J
C
C --- LINEAR LOSS FLS
C
      FLS=((TNU+T**2)/(TNU-1.))*FS - T*GS
```

```
      PRINT 17,FLS
      PRINT 19
C
C --- NET GAIN
C
      FNG=(TFLAM*TTHET*FLS)-TRHO
      PRINT 17,FNG
      FG=.43429 44819 03251 82765 * LOGF(FNG)
      PRINT 17,FG
      PRINT 19
C
 999  CONTINUE
      GO TO 1
      END
```

G.5 Net Gain for Given Optimal Sample Size, Real $\nu < \infty$, $t^2 < \nu$

```
C --- NET GAIN FOR GIVEN OPTIMAL SAMPLE SIZE, REAL NU, CONVERGES FOR
C --- T**2 LESS THAN NU
C
 10   FORMAT(I10)
 17   FORMAT(2E30.20,F10.3)
 18   FORMAT(2E30.20,I5)
 19   FORMAT(1H )
C
      READ 17,TNU,TBETA
      PRINT17,TNU,TBETA
      READ 17,TD,TL
      PRINT17,TD,TL
      PRINT 19
 1    READ 17,TRHO
      PRINT17,TRHO
C
C --- TFLAM,TTHET,T
C
      TFLAM=10.**TL
      TTHET=SQRTF(TRHO/(TRHO+1.))
      T=TD/TTHET
C
C --- DENSITY FS
C
      Z=(1./SQRTF(TNU))*(1./TBETA)
      EXP=(-.5)*(TNU+1.)
      FS=Z*(1.+T**2/TNU)**EXP
      PRINT 17,FS
C
C --- RIGHT TAIL GS
C
      EPS=.1E-10 * 10.**(-T)
C
      FRAC= TNU/(TNU+T**2)
      CON = (FRAC**(.5*TNU))/TBETA
      DELTA = (T**2/TNU) * (EPS/CON)
      ERFAC=1.
      SUM= 1./TNU
      TERM= 1./TNU
C
      DO 340 J=2,1000
      FJ=J
      TINCR= .5*((TNU+2.*FJ-4.)/(TNU+2.*FJ-2.))
     X          *((2.*FJ-3.)/(FJ-1.))
      TERM= TERM*TINCR*FRAC
      SUM= SUM+TERM
      ERFAC= ERFAC*FRAC
      IF(ERFAC-DELTA) 345,340,340
  340 CONTINUE
      GO TO 999
C
 345  GS=CON*SUM
C
      PRINT 18,GS,EPS,J
C
C --- LINEAR LOSS FLS
C
```

```
      FLS=((TNU+T**2)/(TNU-1.))*FS - T*GS
      PRINT 17,FLS
      PRINT 19
C
C --- NET GAIN
C
      FNG=(TFLAM*TTHET*FLS)-TRHO
      FG=.43429 44819 03251 82765 * LOGF(FNG)
      PRINT 17,FNG,FG
      PRINT 19
C
 999  CONTINUE
      GO TO 1
      END
```

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This report contains programs used in computing the tables presented in Jerome Bracken and Arthur Schleifer, Jr., Tables for Normal Sampling with Unknown Variance: The Student Distribution and Economically Optimal Sampling Plans, Division of Research, Graduate School of Business Administration, Harvard University 1964. The tables are essentially of two kinds: tables of the ordinary Student "t" density and cumulative functions, and tables to facilitate Bayesian analysis of certain commonly occurring decision problems in which sampling may or may not be involved. The programs given in this report could be used to compute tables for parameter values other than those of the book either by reading in alternative data, or by straightforward modification where the parameters of the book are included in the programs. The programs are written in FORTRAN II, and in computing the tables in the book they were used on the IBM 7090 and IBM 1401. It should be noted that new programs have been written to perform some of the computations faster, more accurately, or more efficiently.

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